THE STUDY ON ESTABLISHING DIGITAL TOPOGRAPHIC DATABASE FOR BUJUMBURA CITY, BURUNDI

Final Report (Manuals)

March 2013

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

PASCO CORPORATION

Aerial Triangulation

Manual for Aerial Triangulation 1

The Basic Theory of Aerial Triangulation

< Objective>

To calculate orientation parameters for establishing stereo models using the attitude $(\kappa \cdot \phi \cdot \omega)$ and position(X \cdot Y \cdot Z) of each aerial photo. The attitude and position are calculated by analyzing software with the data such as control points.

1. Planning

Index map that principal points of aerial photos, location of control points, leveling routes and so on are drawn shall be prepared. And the time schedule shall be created under consideration of necessary date, assignment of operators and so on.

The following items shall be considered during planning.

- A) The terrains of work area.
- B) The vegetation of work area.
- C) The density of settlement of work area.
- D) Experience of assigned engineer.

2. Preparation

- 2.1 Required equipments, documents and data for this work are followings.
 - A) DPW (Digital Photogrammetric Workstation)
 - B) Software for aerial triangulation
 - C) Calibration report of camera which was used for aerial photography
 - D) Image files
 - E) Photo index map
 - F) Data of exposure station, time, angle and so on (in the case of aerial photography by GPS/IMU)
 - G) Description of control points (data of control points)

Notice : About mentioned on D), the direction of photos should be consistent and **right** angle to the flight direction.

- 2.2 Generation of image files Image files shall be generated depending on the supported format in software used
- 2.3 Creation of control point file

Control point file (above-mentioned on G) shall be prepared depending on the supported format in software used

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Notice : In the case of manual input of control point file, the errors such as type miss should be checked after input. .

2.4 Creation of Camera file

Camera file shall be created by inputting camera calibration data (Focal length, Principal Point coordinate, Image size, Pixel size)

Notice : In the case of manual input of above-mentioned information, the errors such as type miss should be checked after input.

3. Observation of "Pass points", "Tie Pints", "Control Points"

The observation of images should be conducted according to following steps.

Common points must be observed in order to associate with the images of the same course and adjacent course. Generally, common points of same course is called pass points, common points of adjacent course is called tie points.

3.1 Observation of pass point

- ↔ More than 3 points shall be observed in an image. (Point A, Point B, Point C)
- \diamond "Point B" shall be located on the center of image.
- ☆ "Point A" shall be located 7~8 cm above the "Point B". (right angle to the flight direction)
- ☆ "Point C" shall be located 7~8 cm under the "Point B". (right angle to the flight direction)
- ♦ Points shall be located in the area where is clear and flat and lapped by 3 consecutive images (in the case of more than 60% overlap).

3.2 Observation of tie point

Points shall be located in the area where is clear and flat and shall be observed more than 1 point in a model. To improve the connectivity of courses, the location of tie points shall be "Zigzag" arrangement. (in the case of more than 30% sidelap)

Notice : In the case of using automatic-stereomatching function for observation that without distinction between pass points and tie points, the visual check for the number and location of points and the result of auto-matching should be conducted. The area such as forest area and desert area where the auto-matching is difficult because of color toneless should be checked carefully. The errors should be fixed by re-observation or moving points manually.

3.3 Observation of control point

Control points shall be observed after opening the models that the control points or elevation points as a result of minor leveling should be. This observation should be conducted carefully by referring description of control point and pricking photos.

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In case that the points are between adjacent courses, the same method shall be applied.

Notice : In the case of incomplete model which is difficult to observe points because of sea or huge lakes, it is possible to observe points on the sea-level or water surface as the reference point for elevation.

EX Sea-level surface = 0m Water surface of lake A = 35.5m

However, the sea-level surface has tidal difference, therefore the target map scale should be concerned.

4. Adjustment

Geodetic coordinate shall be calculated from image coordinate through the Helmert's transformation with the adequate parameter after the input of observed image coordinate of pass points, tie points, control points and control point file (In case of using GPS/IMU, data of exposure station, time, attitude and camera calibration) into analyze software.

And then, following outputs shall be calculated.

<Discrepancy>

Connection discrepancy: Discrepancy about the connection on the same course or the connection between adjacent courses.

Control point discrepancy: Discrepancy to calculated value from control points (Control point residual).

<Orientation parameter>

The attitude $(\kappa \cdot \phi \cdot \omega)$ and the position $(X \cdot Y \cdot Z)$ of each image.

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5. Check

The results of adjustment should be checked. In case the value is over the limitation value, the observation should be continued until the value is within the limitation value.

5.1 Check result for "Pass points" and "Tie Points"

Check the result whether standard deviation and max of discrepancy of pass points, tie points are within the tolerance.

Calculation	Tolerance
Standard Deviation	within 0.015mm
Max	within 0.03mm

5.2 Check result for "Control points"

Check the result whether standard deviation and max of control point residual are within the tolerance.

Calculation		Tolerance	
X less than		less than "altitude above ground level" x 0.02 %	
Standard Deviation	Y	less than "altitude above ground level" x 0.02 %	
	Ζ	less than "altitude above ground level" x 0.02 %	
	Х	less than "altitude above ground level" x 0.04 %	
Max	Y	less than "altitude above ground level" x 0.04 %	
	Ζ	less than "altitude above ground level" x 0.04 %	

6. Quality Control

Orientation file which is calculated by adjustment shall be imported into DPW with image files and then stereo models shall be established. After establishing stereo models, the following contents shall be checked. During checking, in case the value is over the limitation value, the re-observation should be conducted until the value is within the limitation value.

- 1. There is no the vertical parallax more than 20µm in each model.
- 2. Measuring the same point between models on the same course or between adjacent courses to check the connection.
- 3. Measuring the control points. And the value of the horizontal (X, Y), vertical (Z) and discrepancy shall be checked

Manual for Aerial Triangulation II

The Basic Manipulation of Aerial Triangulation Software

<<u>Objective></u>

This manual makes user appreciate the each steps and contents easily, although a lot of images generally shall be used in general project. Moreover, although there are various options and parameters in each step, any typical options and parameters are selected in each step in this manual.

1. Create a New Block File

1.1 Open LPS

Double click this icon or select "Leica photogrammetry Suite" from the Windows program then The "Project Manager" window appears.



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1.2 Create New "Block file (*.blk)"

Click the following icon then Move into folder and type new file name. And click "OK".

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File			
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file name:	GITEGA_AT		

1.3 Model Set up(Camera type, Coordinate System)

The "Model Setup" window appears then select "Camera" at the "Geometric Model Category:" and select "**Digital Camera**" at the "Geometric Model Category: Camera" and then click "OK".

Geometric Model Category:	_
Camera 🔹	ОК
Geometric Model:	Cancel
Frame Camera	Help
Non-Metric Camera	

Manual for Aerial Triangulation II

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University Containing System	
Projection: Geographic (Lat/Lon)	Previous
Datum: WGS 84	Next
Horizontal Units: Degrees	Cancel
Vertical	Help
Vertical Spheroid: WGS 84 Set	((reap
Vertical Datum: WGS 84	
Vertical Units meters	
Import Set LSR (Unknown) Projection	

In the "Project Chooser" window, click the "Custom" tag and set each value as follow, then click "OK".

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Datum Name:	WGS 84	-	Save
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After "Horizontal" setting, Click "Set..." at "Vertical".

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Reference Coordinate System	
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Import Set LSR (Unknown) Projection	

In the "Elevation Info Chooser" window, choose "Spheroid" and "Datum" as follow, then click "OK".

Spheroid Name	WGS 84			0
Datum Name	World Wide 1-Minute Geoid I	Height (EGM2008)	*	
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Confirm the coordinate system and click "Next".

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Import	Set LSR (Unknown) Projection	

Manual for Aerial Triangulation I1

Set any information as shown below. The value of "Average Flying Height" of aerial photography is input. And click "OK".

	Set Frame-Specific Information:		
Rotation System:	Omega, Phi, Kappa	-	OK
Angle Units:	Degrees	•	Previous
Photo Direction:	Z-axis for normal images	•	Next
			Cancel
Average Flying He	ght (meters): 600	00.000	Help
Import Interior	Drientation Parameters if available		
Sensor Name:	Default Non-Metric 👻 Edit Came	era New Camera	
lm	port Exterior Orientation Parameters		

Import GPS/IMU data with click on "Import Exterior Orientation Parameters".

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Move into folder which contains GPS/IMU file and choose GPS/IMU file then click "OK".

E-mail

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Import Parameters		Manual for Aerial Triangulation L
Map Projection and Units:		
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Choose "Comma" as the Separator Character In the "Field Definition" tag.

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Verify the result of "Field Definition" setting in "Input Preview" tag. If the result is good, click "OK"

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Click "OK" in the "Block Property Setup" Window.

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If the import of GPS/IMU succeeded, the main window looks as follow and all images has been imported automatically.

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2. Add image to the block file

2.1 Add image files

In case of the images were not imported in previous step or no GPS/IMU, Click following icon in the "Project Manager" window to open images.

₽

In the "Image File Name" window, select appropriate image after moving to folder where images are stored. Select appropriate file type at "Files of type:" and click "OK".

Image File Name				
File				
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Burundi_10_0560.tif	Burundi_11_0802.tif	🗃 Burundi_9_0364.tif		OK
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	Row # 20 21 22 23 24 25 25 26 27 28 20 20 20 20 20 20 20 20 20 20 20 20 20	image ID 20 21 22 23 24 25 26 27 28 29 30 31	Discopson (3	Image Hane 4 Anomet Universe of Air ages (Appendixmed, TT, 1992 B) 4 Anomet, Universe of Air ages (Appendixmed, TT, 1992 B) 4 Anomet, Universe of Air ages (Appendixmed, TT, 1997 B) 4 Anomet, Universe of Air ages (Appendixmed, TT, 1997 B) 4 Anomet, Universe of Air ages (Appendixmed, TT, 1997 B) 4 Anomet, Universe of Air ages (Appendixmed, TT, 1997 B) 4 Anomet, Universe of Air ages (Appendixmed, TT, 1997 B) 4 Anomet, Universe of Air ages (Appendixmed, TT, 1997 B) 4 Anomet, Universe of Air ages (Appendix Appendix Appendix 4 Anomet, Universe of Air ages (Appendix Appendix App	Active P	A IN EN	EX Pour Creas D TM Office Online		1.11
	Rue # 20 21 22 23 24 25 25 25 26 27 28 27 28 27 28 27 28 27 28 27 28 27 28 27 28 27 28 27 28 29 29 20 21 20 20 21 20 20 21 20 20 20 20 20 20 20 20 20 20 20 20 20	Image (D) 201 222 233 244 255 238 237 238 233 301 311 322	Desception 2	Ingen Name 4 Annovet, Linemagi Aringgar Japan Januari, TT, 1989 Bi 4 Annovet, Linemagi Aringgar Japan Januari, TT, 1989 Bi 4 Annovet, Linemagi Aringgar Japan Januari, TT, 1999 Bi 4 Annovet, Linemagi Aringgar Japan Januari, Ji Billi Bi 4 Annovet, Linemagi Aringgar Japan Jahuari, S. 2023 4 Annovet, Linemagi Aringgar Japan Jahuari, Japan Japan Jahuari, Japan Japa	Active P	H WL EN	IDS Pour Creess In En	(index)	100
	Rom # 20 21 22 23 24 25 26 27 28 27 28 27 28 27 28 27 28 27 28 27 28 27 28 27 28 28 28 28 28 28 28 28 28 28 28 28 28	Intege (D) 20 21 22 23 24 25 26 27 28 20 30 31 22 23 24 23 23 31 31 22 23 24 23 23 24 23 23 24 23 24 23 24 23 24 23 24 23 24 25 24 25 24 24 25 24 24 25 24 24 25 24 24 25 25 24 25 25 25 25 25 25 25 25 25 25 25 25 25	Desception ()	Image Hane 4 Anomet Universely de ranges (algus y faunci, 17, 1899 B) 4 Anomet, Universely de langes (algus y faunci, 17, 1899 B) 4 Anomet, Universely de langes (algus y faunci, 17, 1897 B) 4 Anomet, Universely de langes (algus y faunci, 17, 1897 B) 4 Anomet, Universely de langes (algus y faunci, 17, 1897 B) 4 Anomet, Universely de langes (algus y faunci, 18, 1897 B) 4 Anomet, Universely de langes (algus y faunci, 18, 1897 B) 4 Anomet, Universely de langes (algus y faunci, 18, 1897 B) 4 Anomet, Universely de langes (algus y faunci, 18, 1897 B) 4 Anomet, Universely de langes (algus y faunci, 18, 1897 B) 4 Anomet, Universel (algus y faunci, 18, 1897 B) 4 Anomet, Universel (algus y faunci, 18, 1897 B) 4 Ano	ACW2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		IIII Powr Crease D TH. Office Online	(ester	1
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	Rue # 20 21 23 24 25 25 27 28 27 28 27 28 27 28 27 28 27 28 29 27 29 29 20 21 20 21 22 24 25 25 27 29 20 21 20 21 22 22 24 25 25 24 20 20 21 22 22 24 25 25 24 25 25 24 25 25 25 25 25 25 25 25 25 25 25 25 25	10000000000000000000000000000000000000	Desception (2)	Image Hane 4 Anomet U menergi Almaper (App Anamet, 17, 1999) a 4 Anamet, U menergi Almaper (App Anamet, 17, 1999) a 4 Anamet, Tamera (Almaper (App Anamet, 17, 1999) 4 Anamet, Jamera (Almaper (App Anamet, 17, 1997) 4 Anamet, Jamera (Almaper (App Anamet, 17, 1997) a 4 Anamet, Jamera (Almaper (Almaper (App Anamet, 17, 1997) a 4 Anamet, Jamera (Almaper (App Anamet, 1997) a 4	Active P		IEX Part Crease In En	ANDEL	

Manual for Aerial Triangulation II

2.2 Coumputation of pyramid layers

To create the pyramid layer, click column of "Pyr." as shown below.

					Point	Criteria	90			
					0		r T	ay(s)		
Image Name	Active	Pyr.	Int.	Ext.	DTM	Ortho	Online		*	
ect_trainning/at/images/gitega/burundi_11_0808.tif	~									
ect_trainning/at/images/gitega/burundi_11_0809.tif	~									
ect_trainning/at/images/gitega/burundi_11_0810.tif	~			<u>></u>						
ect_trainning/at/images/gitega/burundi_11_0811.tif	~		∕ ∕							
ect_trainning/at/images/gitega/burundi_11_0812.tif	~									
ect_trainning/at/images/gitega/burundi_9_0362.tif	~									
ect_trainning/at/images/gitega/burundi_9_0363.tif	~									

The "Compute Pyramid Layers" window appears. Select the "All Images Without Pyramids" and click "OK".



After completing generating pyramid layers, color of column of "Pyr" turns to green from red.



Manual for Aerial Triangulation II

3. Camera File Setting (Creation)

Click following icon then "Frame Camera Frame Editor" window appears. To create a camera file, click "New Camera...".

iensor	Interior Orientation Exte	arior Information	-
	Image File Name:	burundi_10_0560 tif Attach View Image Edit All Images	Previou
	Block Model Type:	Digital Camera	Next
	Sensor Name:	Default Non-Metric Edit Camera New Camera	Help

Fill "General" tag referring "Camera Calibration Report" then "Save" and "OK".

Camera Nama	rx.		OK
Description:	IICA_training	-	Save
Focal Length (mm):	100.5000		Load
Principal Point so (mm):	-0.2160		Cancel
Principal Point yo (mm):	0.0000	*	(use
Use Extended Camera Mo	del Edit Exter	ided Parameters	

P Large Format Pa	anchro	matic Came	ra
Image Format	long track	67.824mm	9420pixe
	cross track	103 896mm	14430pixe
Image Extent		(-33.91, -51.95)mm	(33.91, 51.95)mm
Pixel Size		7.200µm*7.200µm	
Focal Length	ck	100.500mm	± 0.002mm
Principal Point	X ppa	0.000 mm	± 0.002mm

Multispectral Camera

Medium Format Multispectral Output Image (Upscaled to panchromatic image format)

Image Format	long track	67.824mm	3140pixel
	cross track	103,896mm	4810pixel
Image Extent		(-33.91, -51.95)mm	(33.91, 51.95)mm
Pixel Size		21.600jum*21.600jum	
Focal Length	ck	100.500mm	
Principal Point	X ppa	0.000 mm	± 0.002mm
(Level 2)	Y ppa	0.216 mm	± 0.002mm
Lens Distortion	Remaining	Distortion less than 0.003	2000

Input the Pixel size of the camera(from "Camera Calibration Report") in the "Interior Orientation"

tag.

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Sensor	Interior Orientation	Exterior Information			
	Pixel size	e in x direction (microns):	7.2000	*	DK. Previou
	Pixel size	e in y direction (microns):	7.2000		Next
	📝 Appl	y to all active frames			Help

If camera file has already created, it is possible to load it by clicking "Load".

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Manual for Aerial Triangulation I1

4. Observation of GCPs

- 1. Click this icon in the "Project Manager" window.
- 2. The "Select Point Measurement Tool" window appears. Select "Classic Point Measurement Tools" and click "OK".



3. The "Point Measurement" window appears as shown below.

It is possible to change left and right image file at the following palette at the right side of the "Point Measurement" window.



This is tool palette.



Add	Add new point
Delete	Delete selected p
Close	Close point mese
Save	Save current bloc
Help	Point measurmen

oints

earment tool

k

nt tool help

Manual for Aerial Triangulation II

4. In this manual, it assumes that a control file is prepared as text file as shown below. The coordinate system is same with the "block file".



5. Click this icon in the tool palette.

r		_	
Ш		T	
ш	-	_	
U			

6. The "Import/Export Points" window appears. Select options as shown below and click "OK".

OK Cancel Help
Cancel Help
Help

7. "Reference ASCII file:" window appears. Select the appropriate file and click "OK".

GCP_Survey_Results	- 🖻 🐨 🛥 🛞	
SHP Points List and Description	B SHP_BUJUMBURA.txt	OK.
oint List and Description		Cancel
ning.txt		Help
UMBURA, TXT JUMBURA, txt FEGA INI t t txt		Recent Goto
m	- tr	
GCP_GITEGA.txt		
Beference ASCIL (* tyt)	• *	
	GCP_Survey_Results SHP Points List and Description foint List and Description ning.txt e.txt UMBURA.TXT JUMBURA.TXT JUMBURA.txt EGAINT t t GCP_GITEGA.txt Beference ASCII (* txt)	GCP_Survey_Results

8. The "Reference Import Parameters" window appears. In this window, map projection and units are set as shown below. And click "OK".

Reference Imp	port Paran	neters	2.0	
ap Projection an	d Units;			-
Projection: Spheroid: Zone Number: Datum:	Trans WGS WGS	everse Mercator 84 84	Set	OK
Horizont	al Units: Set	Meters Elevation Info	•	

9. Although the "Attention" window appears, click "Yes".



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Manual for Aerial Triangulation II

10. The "Import Options" window appears. Set any options as shown below and click "OK".

te to import From: d:	/!project_trainning/at/gcp_survey_results/	gep
Field Definition Input Previo	ew	
Field Type: Delimited	by Separator 👘 Fixed Width	
Separator Character:	Comma	•
Row Terminator Character:	NewLine (Unix)	-
Comment Character:		-
Number of Rows To Skip:	1	
Column Mapping		
Output Column Name	Input Field Number	-
Ref_ID	1	1
X	2	ł
	9	81

11. The coordinate values of GCPs are loaded as shown below.

eft Image	d./IPRO	JE~1/at/imag	ges/gitega/BU0	185~1.TIF		Right Image:	d:/IPROJE~1/at/im	ages/gitega/	BUE54D~	TIF		× L		Add
									10-					Delete
								1				€£] 4 °		Close
												······································	Z_ & 01	Cioco
12	-4	<u>i</u>								- 4 -		PX		Save
		8					- AK			11.54		00		Help
								1		24				
1							R.C					🔲 Use V	liewer As Referenc	e
	-				1.0	1000	10.05	-		-	T	Left View	d://project_trai	nning/at.
				89a -			1. 1.38					Apply Apply	Image Shift	
							122		100	100		X 50	ī : 0 — 0 -	100
				10		1000		100	1.0	100	100	0 50	1 ÷ 0 — 0	100
						N COM				Re 1	16.	A	ply R	eset
				lease.	10	- 44	26 152		9.9	14		-	1	
			<u></u>			8	1 88	<u> </u>	1870	100		Right View	v: d://project_trai	nning/at.
			-		- 65	2 N A	1. 10. 10				100	Apply	Image Shift	
41			-		192			\square		100	1.2	\$ € 50	i : 0()	100
		A		195			10.00		- 1			0 50	ĭ∶o — O	100
	5.11										. 18	A	aply R	eset
10							1 1 3	Sec.			2.2	Horizonto	-	
10.00	1 A A	- 32				1.00	1.1.1.	5. 20	2.11			Vertical: n	one	
			U.S.			1 A 1	14 - E	100	0			1. Desident		
oint #	Point ID	> Descrip	ation Type	Usage	Active	×Reference	Y Reference	ZRe ^	Image #	Image	Name	Active >	(File)	File
1	1		Full	Control	~	493780.640	9624476.956							
2	2		Full	Control	~	486804.967	9624565.624							
4	4		Full	Control	~	494757.963	9616918.783							
5	5	•	Full	Control	~	487358.062	9617162.173							
	-							, -		im				-
											-			_

12. Move to the location of GCP 1 by moving the geographic link box.



By clicking this icon, it is possible to add a column of color.

Select "Advanced" and "Color" in the "Viewing Properties". And click "OK".

Point Table Info:	Point View Info:				
🔘 Simple	I AI	OK			
Advanced	💮 Selected Only	Cancel			
Color		Help			
Std.					
Residual					

P

Manual for Aerial Triangulation II

13. Click this icon to start observation of GCPs. Mouse cursor shall be changed.



14. GCP is observed on every appropriate photo images in reference to description of control point. (In this manual, description of control point indicate Appendix) This is case of GCP 1. Because GCP 1 must be on 3 images as shown in Appendix, name of 3 images is listed in the column of "Image Name" as shown below.



15. If this icon is on, the geographic link box shall move automatically to rough corresponded location after more than 3 points are observed on each image.

怡

- 16. After the observation of GCPs, click "Save".
- 17. It is possible to change the type of GCPs and usage of points as necessary.

"Lmb" on column of "Type", it is possible to change the type.

Point #	Point ID	5	Description	Туре	Usage	Active	XReference	Y Reference	Z
1	1	1		Full	Control	~	493780.640	9624476.956	
-0	2			Full	A . To	~	486804.967	9624565.624	
3	3			Full	ASIS	~	492500.576	9621028.126	-
4	4	1		Full	Fight State	4	494757.963	9616918.783	
5	5			Full	Horizontal	~	487358.062	9617162.173	

"Lmb" on column of "Usage", it is possible to change the usage type.

Manual for Aerial Triangulation II

Point #	Point ID	>	Description	Туре	Usage	Active	XReference	Y Reference
1	1			Full	Control	-	493780.640	9624476.956
	2			Full	Contr	**	486804.967	9624565.624
3	3			Full	Contr	As Is	492500.576	9621028.126
4	4			Full	Contr	Tie	494757.963	9616918.783
5	5			Full	Contr	Control	487358.062	9617162.173

18. Location of GCPs shall be displayed as shown below in the "Project Manager" window.

	0		Z 🙎	田					-		_
Block - gitega_test.bl									Display	Mode	
Orthos					C Burney R. L. (Barren)				Map	Space	
DTMs					Burund Burund Burundi 11_0801				() Imag	e Snace	
					Eurond Borondi_11_0802.00				C may	o opuoo	
					Budding				🔽 Imag	ge Extents	
				t	Bunarate Bunard_11_D804.0				🔽 Imag	pe ID s	
					Frounds				Con	rol Points	\triangle
				E	Beneral Summer Bound (1,0806.0				Tie S	Paints	
					Burry 1 1807.0					LE	0
				F	Banada Banada Banageh Ta 1999-10				UV Che	ok Points	0
				E	and i waild more an owner				Poin	tIDs	
				Ľ	Autoration - Building Topole in				V Resi	duals	
					Bandak Barande 11_210.66				Residua	Scaling %	
					Bound B Diversion Burnet 11_DB11.0				100		
					Buond_9_03/5% Bondhoi_11_0812.0				Point Dr	iteria	
									0	*	ray(s)
	Row #	Image ID	Description	>	Image Name	Active	Pyr.	Int.	Ext. DTM O	the Online	-
	1	90362		•	d://project_trainning/at/images/gitega/Burundi_9_0362.tif	4					
	2	90363		-	d./project_trainning/al/images/gitega/Burundi_9_U363.tit d./project_trainning/al/images/gitega/Burundi_9_0364.tit	~		-			
	4	90365			d/project_training/at/mages/gitega/Burundi 9 0365.tif	4		-			E
	5	90366			d://project_trainning/at/images/gitega/Burundi_9_0366.tif	*					
	6	90367			d://project_trainning/at/mages/gitega/Burundi_9_0367.til	*					
	7	90368			d://project_trainning/at/images/gitega/Burundi_9_0368.tif	4					
	8	90369			d://project_trainning/at/images/gitega/Burundi_9_0369.tif	*					
	9	90370			d://project_trainning/at/images/gitega/Burundi_9_0370.tif	4		<u> </u>			
	10	90371			d //project_trainning/at/images/gitega/Burundi_9_03/1.tf	*		Ļ			4
	11	90372	-	-	d://project_trainning/at/images/gitega/Burundi_9_03/2.tit			-			4
	12	303/3			ct./tproject_trainning/at/images/gitega/Burundi_9_03/3.tit			-			
	13	100560			d.r/project_r/anining/at/images/grega/Burundi_10_0560.bf	¥		-			
	14	100561			d://project_trainning/at/images/gitega/Burundi_10_0561.bit	*					
	10	The second se			and the second						

5. Generation of automatic tie point

1. Click this icon in the "Point Measurement" window to generate tie points. In this software (LPS), both tie points and pass points are called tie points.

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H	-
U	-

2. The "Automatic Tie Point Generation Properties" window appears. In the "General" tab, set options as shown below.

	Manual for Aerial Triangulation II
Automatic Tie Point Generation Properties	
General Strategy Distribution	
Images Used: 🧕 All Available 💮 Active	Images Only
Initial Type: 👘 Exterior/Header/GCP 🍥	Tie Points
Image Layer Used for Computation:	1
Existing Point Transfer: No Transfer, Nev	Points Only 👻
OK Bun Car	ncel Help

3. In the "Strategy" tab, set parameters as shown below.

General	Strategy	Distrib	ution			
	Searc	h Size:	21	*	Feature Pt Density	100%
	Correlatio	n Size:	7	*	Coefficient Limit	0.80
L	.east Squar	e Size:	21	*	Initial Accuracy	10%
Avoid	Shadow:	V	Image	e Scanned	: 💿 Positive 🔘	Negative

4. Click the "Distribution" tab. In case of the visual check of the layout of tie points, "Lmb" "View Graphic". also number of tie points and the layout are able to be changed.

General Strategy Distribution	
Contractor Contractor Contractor	
Find Points With: 👘 Default Distribution 💿 Defin	ned Pattern View Graphic
Intended Num. of Points/Pattern: 1	E Keep All Points
Starting Column: 942	Starting Line: 1443
Column Increment: 1884 🚔 Line	e Increment: 2886 🚔





5. Set parameters in the "Distribution" tab as shown below. And click "Run".

	Manual for Aerial Triangulatio
Automatic Tie Point Generation Pro	perties ×
General Strategy Distribution	
Find Points With; 👘 Default Distribution	Defined Pattern View Graphic
Intended Num. of Points/Patter	n: 1 👘 Keep All Points
Starting Column: 942 🚔	Starting Line: 1443
	2017

6. The "Auto Tie Summary" window appears and the result of automatic tie points generation is shown.

Auto Tie	e Summary	8				-	×
Row #	Image ID	Image Name	Number of Intended Points	Number of Found Points	Number of Patterns	Point Success Rate % P _	Benot
1	110803	Burundi_11_0803	18	13	9	72.22	[mean
2	110804	Burundi_11_0804	18	20	9	100.00	Close
3	110805	Burundi_11_0805	18	20	9	100.00	
4	110806	Burundi_11_0806	18	19	9	100.00	Help
5	110807	Burundi_11_0807	18	12	.9	66.67 E	, reik
1	m						
Average I	Point Succe	ss Rate (%): 8	7.78 Average Patte	rn Success Rate (%):	86.67		
Total unio	and the second of	3	2				

7. By clicking "Report", the report opens

	The Aut	otie Summary Rep	ort			
Image	Number of	Number of	Number of	Point	Pattern	Image
ID	Intended Points	Points Found	Patterns	Success Rate	Success Rate	Name
110803	18	13	9	72.22%	66.67%	Burundi_11_0803
110804	18	20	9	100.00%	100.00%	Burundi_11_0804
110805	18	20	9	100.00%	100.00%	Burundi_11_0805
110806	18	19	9	100.00%	100.00%	Burundi_11_0806
110807	18	12		66.67%	66.67%	Burundi_11_0807
verage Point verage Patter 'otal unique t	Success Rate: n Success Rate: ie points found:	87.78% 86.67% 32				

8. In the "Point Measurement" window, generated tie points are displayed as shown below then Visual check of tie points generated automatically must be conducted one by one clicking each row.



9. If a tie point is not observed correctly, it is possible to eliminate it by clicking target cell as shown below (Off Active: Delete Check mark).

		1	Description	Туре	Usage	Active	XReference	Y Reference	ZRe	1	Image #
34	34			None	Tie						-
35	35			None	Tie	-					
36	36			None	Tie	4					
37	37			None	Tie	4					
	38			None	Tie						
39	39			None	Tie						
40	40			None	Tie	4				=	1000

6. Block Adjustment

- 1. Click this icon to set any options for aerial triangulation.
- The "Aerial Triangulation" window appears. In the "General" tab, set options as shown below. Convergence value shall be "0.0001" in case of large scale map, and "0.01" in case of small scale map.

R

Manual for Aerial Triangulation II

General Po	int Interior Exterior	Advanced Options	OK
Maximum	Iterations:	10.	Run
Converge	nce Value (meters):	0.000100	Update
Comp	ute Accuracy for Unkno	owns	Accept
Image Co	ordinate Units for Repo	rt Pixels 🔹	Report.
			Cancel
			Help

3. In the "point" tab, set options as shown below.

General	Point	Interior	Exterior	Advanced	Options		- OK
Imag	ge Point	Standard [eviation:	s (pixels) :			Bun
		× 0	.33	A M			Update
		y: c					Accept
GCP T	ype and	Standard	Deviation	is (X,Y: mete	rs, Z: meters):		Report.
		Type:	Same	weighted va	lues	•	Cancel
		X: 0 Y: 0	.500000 .500100	X Z:	0.500000	A	Help

4. In the "Interior" tab, set options as shown below.

General Po	int Interior	Exterior	Advanc	ed Options	-	ОК
Тур	e: Fixed fo	or all image	\$		-	Run
Star	ndard Deviati	ons (mm):				Update
Fos	al Length;	0	0.010			Accept
Prov	sipal Point xo	e [0	0.010	+		Report
Pon	sipal Point yo		0.010			Cancel
						Help

5. In the "Exterior" tab, set options as shown below. Normally, standard deviation is not set because exterior orientation parameters are unknown.

Manual for Aerial Triangulation II

General	Point	Interior	Exterior	Advance	dOptions		OK
	Type:	No weig	ht		•		Bun
	Standa (Xo,Yo	ard Deviatio 5: meters, Z	ins: lo: meters,	. Angles: de	grees)		Update
	×0:	10.000000	-	Omega.	0.10000		Accept
	70	10.000000	*	Phic	0.10000	-	Report
	20	10.000000		Карра	0,10000		Cancel
							Help

6. In the "Advanced Options", set options as shown below.

Aerial Triangulation	and the second second	×
General Point Interior Ext	erior Advanced Options	OK.
Additional Parameter Model:	No additional parameters 🔹	Bun
Use Additional Parameters A	s Weighted Variables	Update
Blunder Checking Model	No automatic blunder checking =	Accept
Use Image Observations of I	Check Points in Triangulation	Report
Consider Earth Curvature in	Calculation	Cancel
Define Topocenter (Degrees	s)	Help
Longibilde: 0.000000	Lahlude: 0.000000	

- 7. After any options are set correctly, click "Run" to execute triangulation.
- 8. After finishing triangulation, the "Triangulation Summary" window appears.

Triangulati Total Imag	Close			
Control F	oint RMSE:	Check P	Update	
Ground X:	0.1388 (5)	Ground X:	0.0000 (0)	Accept
Ground Y:	0.1567 (5)	Ground Y:	0.0000 (0)	Report
Ground Z:	0.3863 (19)	Ground Z:	0.0000 (0)	Review
Image X:	0.5128 (69)	Image X:	0.0000 (0)	Help
Image Y:	0.4382 (69)	Image Y:	0.0000 (0)	

9. If the values are satisfied with the limitation value, click "Accept".

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10. By clicking "Report", the report opens as shown below.

It is strongly recommended to save the report.

Edit View Find	Help		
NRAX			
The '	Iniangulation Par	ant With TPC	
	riangulation kep	STC WICH ENG	
The out	out image x, y un: out angle unit:	ts: pixels. degrees	
The outp	out ground X, Y, S	1 units: meters	
The	e Input Image Coo:	dinates	
Point ID	image ID = 9)	J362 V	
6	8165.631	773.162	
7	6121.567	1806.052	
9	8359 406	2380 772	
10	6785.110	8049.042	
11	7389.362	7999.124	
12	5931,117	8819,667	
14	7390.044	12689.976	
15	8731.254	12628.280	
17	8629,040	8341,903	
20	7910,523	12647,493	
127	8724.667	4423.553	
128	6832,373	3509.037	
136	8247.410	4559.398	
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-33.9084	A1 0.007200 0.00	12 BU 3000 51.9444	B1 0.000000 -
	image ID = 9	1363	
Point ID	x	y	
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7	2590,817	1273,475	
8	2991.594	1144.501	
.9	4883,660	1856.251	
10	3278.937	7557,830	
12	2422.129	8383.354	
13	3061.759	12129.110	
14	5229,149	12220.395	

- 11. To close the "Triangulation Summary" window, click "Close".
- 12. To close the "Aerial Triangulation" window, click "OK".

General Point Interior Ext	erior Advanced Options	- OK
Additional Parameter Model:	No additional parameters	Run
Use Additional Parameters A	s Weighted Variables	Update
Blunder Checking Model	No automatic blunder checking	Accept
Use Image Observations of	Check Points in Triangulation	Report
Consider Earth Curvature in	Calculation	Cancel
Define Topocenter (Degree:	s)	Help
Lanatude: 0.000000	Estitude 0.000000	

 To save the result of aerial triangulation, click "Save" and "Close" in the tool palette of the "Point Measurement" window

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14. In the "Project Manager" window, column of "Ext" turns to green as show below.

7. DEM extraction

1. Click this icon in the "Project Manager" window to generate DEM then choose "Classic ATE" in the following window.

Ζ



2. The "DTM Extraction" window appears. Set options as shown below. The output file shall be

Manual for Aerial Triangulation 11 set in any folder. Generally, cell size should be 3 times bigger than resolution of image.

Output Type:	DEM		•	Backg	round Valu	e: Defaul		ОК
Output Form:	Single	Mosaic 🔘 li	ndividual	Files				Bun
Output File:	gitega_se	e_dem.img			G.			Batch
					100			Cancel
Cell Size	X: 10.0	D A	Y:	10.00		meters	•	Help
	🔲 Make	Pixels Square						
🔲 Use Adapti	ve ATE		Stop at	Pyramid:	0			
Set the range	Hom:	globaldem2	2.jp2		M			
DEM accurac	y.	25.00	A.	meters				
Z Search Ran	ge Min	1518.00	M	вя 1939.	37	meters		
					1	Advanced Pr	operties	

- 3. Click "Advanced Properties...".
- 4. The "DTM Extraction Properties" window appears. Select parameters as shown below.

Horizontal Projection: Transverse Mercator Horizontal Spheroid: WGS 84 Zone Mumber Horizontal Datum: WGS 84 Horizontal Units: meters Set Vertical Spheroid: WGS 84 Vertical Datum: World Wide 1-Minute Geoid Height (EGM2008 Vertical Units: meters Set	DTM Extent Two Corners (in ground space) UL 485720.4583 9628238.3300 LB 485250.1500 9613003.8823	OK Cancel Help
Create DTM Point Status Output Image Reduce DTM Correlation Area by Trim the DTM Border by	Contour Map Contour(Interval 30.00 2000	

5. By clicking the following icon in the "Image Pair" tab, it is possible to display the view of image pair.

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eneral Image Pair Area Selection Accuracy Seed D	ata		Terry States and States		
Recalculate pairs with overlap over 50%	Show Active Only		🔿 🖉 🗙 🔺		
Row # > Image Pair Name	Active Overla	ap % Onen viewerfor in	nage nair selection	OK	
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6. In the "Area Selection" tab, click the following icon.

Current P	air:	burundi_11_08	10_bur	undi_11_0811		•					
Row #	*	Region Description Default Region	Active	Strategy Default	Region Z. Undefined	Min Z 1650.0000	Max Z 1939.3702	·	×, *,		OK Cancel Help
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How # Image Pair Name	Region Description	Active	Strategy	RegionZ	Min.
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25 burundi_11_0803_burundi_11_0804	Default Region		Default	Undefined	1562
26 burundi_11_0804_burundi_11_0805	Default Region	~	Default	Undefined	1568
27 burundi_11_0805_burundi_11_0806	Default Region		Default	Undefined	1573
28 burundi_11_0806_burundi_11_0807	Default Region		Default	Undefined	1618
29 burundi_11_0807_burundi_11_0808	Default Region		Default	Undefined	1631
30 burundi_11_0808_burundi_11_0809	Default Region		Default	Undefined	1622
31 burundi_11_0809_burundi_11_0810	Default Region		Default	Undefined	1622
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7. The "Edit strategies for all regions" window appears. It is possible to set circumstance of target area by clicking column of "Strategy" as shown below. And then click "OK".

8. In the "Accuracy" tab, any options shall be set as shown below.

General Image Pair Area 9	election	Accuracy	See	d Data		$\langle \rangle$				
Use Black Check Points	0	Show	v Ima	gėlD 📋	Show Po	int Ib 🔲 💽				
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		1	0	20	4 🖌	488029.306	9617668.888			
		1	1	20	5 🗸	491185.347	9620825.659		-	
			411	-						

9. By clicking this icon, the view is displayed as shown below. And then click "OK"
| DTM Francisco Deconstant | _ | | | - | | _ | wiun | | X | mangalali |
|--|-------------------------------|---|--|-------------------------------|---|---|--------------|-------|---------------------|-----------|
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ance/ | |

10. In the "DTM Extraction" window, click "Run".

Output Type:	DEM		Backgro	ound Value:	Default	•	OK
Output Form:	Single Mo	osaic 🔘 Individi	ual Files			1	Run
Output File:	gitega_se_c	lem.img		<u>é</u>		[Batch Cancel
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11. After DTM extraction, column of "DTM" turns to green.

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Row #	Image ID	Description	>	Image Name	Active	Pyr.	Int.	Ext.	DTM	Ortho	Online		
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2	90363			d:/!project_trainning/at/images/gitega/burundi_9_0363.tif	~								Ļ
3	90364			d:/!project_trainning/at/images/gitega/burundi_9_0364.tif	~								
4	90365			d:/!project_trainning/at/images/gitega/burundi_9_0365.tif	~							-	
5	90366			d:/!project_trainning/at/images/gitega/burundi_9_0366.tif	~								
6	90367			d:/!project_trainning/at/images/gitega/burundi_9_0367.tif	~								
7	90368			d:/!project_trainning/at/images/gitega/burundi_9_0368.tif	~							12	
8	90369			d:/!project_trainning/at/images/gitega/burundi_9_0369.tif	~								
9	90370			d://project_trainning/at/images/gitega/burundi_9_0370.tif	V								

12. To check the result of DTM Extraction, open the report from the menu bar of the "Project Manager" window.

ile Edit	Process Tools Help	
Block	Automatic Tie Point Generation Triangulate Triangulation Report Project Graphic Status DTM Extraction	B B B burundi_9_05894941di_10_0561_04546_11_0801_04 080234
	DTM Extraction Report	burundi 9-0 burundi 10,02 bulundi 11_0803.ti
	Interactive Terrain Editing Ortho Rectification Mosaic Feature Collection	 Hurund 9 p Burundi 1000 Hurundi 11,0004 h burund 9 0 Swandi 10 0 Bahindi 11,0805 burund 9 0 Swandi 10 0 Bahindi 11,0805 h

13. The report opens as shown below. In the report, the general quality information, general vertical and horizontal information and so on are described.

rieporcine.	Current File	
Erp)	DTM Extraction Report Date Created: 03/14/12 Time Created: 15:55:42	I
	DTH PROJECT INFORMATION	
	Block File Used: syori_gitega_1955 - copy.blk Block File Location: d://project_trainning/at/ DTM Correlation Time (seconds): 322 Points Per Second: 3167.981 DTM Generation Time (seconds): 38 Total Processing Time : 6 mins 0 secs	
	DTM Type: DEM DTM Name: d:/!project_trainning/at/dem/aloys2.img Number of Columns: 956 Number of Rows: 1269 Cell Width: 10.000 meters Cell Heicht: 10.000 meters	
	DTM Type: DEM DTM Name: d://project_trainning/at/dem/aloys2.img Number of Columns: 958 Number of Rows: 1269 Cell Width: 10.000 meters Cell Height: 10.000 meters	
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Manual for Aerial Triangulation II

8. Orthorectification

This function is used for the Orthorectification Process one image by one image.

1. Choose a target image and Click this icon to generate ortho image in the "Project Manager" window.

2.	The "Ortho Resampling" window appears.	In this window, set options as shown below.	DEM
	file which was generated in above process s	hall be set in this window.	

87

Rescale Adv	vanced			_
Input File Name:	burundi_11_0809.tif	Active Area:	100.0%	e OK
Output File Name: (*.in	ig) orthoburundi_1	1_0809.img	• 6	Batch
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3. In the "Advanced" tab, set options as shown below. And click "OK".

neral Rescale Advanced				
Resampling Method: Cubic Conv	olution	* *	OK.	
Overlap Threshold: 30.0%	☑ Output Ignore Value: 0.00	0000	Batch	
Set Inclusion Polygons	Set Inclusion Polygon Name Mai	tehing	Cancel	
Inclusion Polygon File Name (File)		- 6	Help	
Zone Number: Datum: WGS 84 Horizontal Units: meters	Reset Projection and	d Units		
Add Add Multiple De	ete	Align Pixels	Show Path	
ow # Input Image Name > Activ 1 burundi_11_0809.tif ▶ ✔	e Output Image Name Act orthoburundi_11_0809.im	tive Area Inclus 100	ion Polygon Na 🐣	

4. After the ortho image was generated, column of "Ortho" turns to green.

									100 Point 0	t Criteria	- 	▼ ay(s)		
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	110811		Þ	d:/!project_trainning/at/images/gitega/burundi_11_0811.tif	~								10	
4	110812			d:/!project_trainning/at/images/gitega/burundi_11_0812.tif	~									

Manual for Aerial Triangulation II

9. Orhtorectification and Mosaicking

This function is used for the Mosaicking Process for images orthorectified in previous process.

1. Click this icon to execute ortho-mosaicking. Above orhto image generation is for individual image. On the other hand, this ortho-mosaicking can generate ortho images of large area at once.



2. The "Mosaic Tool" window appears.

iasaicPra (Na File)			0 0 2
Edit View Prosess Help			
		To 45 45 45	6 B 6 6
	Start ortho mosaicking process		
	Enventions Science.		
	Source Reference Cooldrule System		
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3. In the "Elevation Source..." window, select "DTM File" and set appropriate DTM file. And then click "OK".

Source	Reference Coordinate System	
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	gitega_se_dem.img 🔹 🛱	
-		
	OK Can	cel Help

Manual for Aerial Triangulation I1

4. The "Add Images" window appears. In the "Image Area Options" tab, select "Compute Active Area" and click "Set…".

Add Images	
File Image Area Options	0
O Use Entire Image	OK.
Crop Area By: 02 - Parami	Cancel
Template ADI (common for all images)	Help
🗇 Individual AOI	
 Auto-associate Multiple ADI Files Auto-associate Multiple Shapehles Single Aggregate Shapehle 	Goto
Single AOI File Crop Area: 0.100%	

5. In the "Active Area Options" window, set options as shown below. And click "OK".



6. In the "Add Images" window, click "OK".

	Manual for Aerial Triangulation
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🗇 Use Entire Image	OK
🗇 Crop Area By: 0% 🚔 Percent	
Compute Active Area	Cancel
💬 Template AOI (common for all images)	Help
🗇 Indivídual AÖI	
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Auto-associate Multiple Shapefiles	
Single Aggregate Shapefile	Goto
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Crop Area. 0.100% 💠	
Set	
Block Image Type: Orthos Set Elevation Source	

7. In the "Mosaic Tool" window, footprint of image shall be displayed as shown below.

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-								_			-
			-				-	_			0

8. Click this icon. Set options as shown below in the "Image Resample Options" window and click "Apply".



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×	16	* Y:	16	*
MS Tol	erance:	0.10	(A) (V)	Pixels
ethod:	Cubic	Convolu	tion	-

Manual for Aerial Triangulation I1

9. Click this icon. Select options as shown below in the "Color Corrections" window and click "OK".

or corrections can be done using Illumination Equidging, Color Balancing, Histogram Matching, or a these options. Specific areas can be excluded from mputing using ExcludeAreas. When using two or tions, they should be performed in the order they log, from top to bottom.	alizing, Image ny combinatio im statistics more of these appear in the
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Exclude Areas	Set.
🔲 Use Illumination Equalizing	S'et.
🔽 Use Image Dodging	Set
Use Color Balancing	Set.
📃 Use Histogram Matching	Set .
DUIDER DUIDER	+
FIXELVAUE VDE FIXELVAUE	

10. Click this icon for setting of automatic cutline.

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11. In "Cutline Generation Options" window, select "Weighted Cutline" and click "Set...".



Manual for Aerial Triangulation I1

12. In the "Weighted Cutline Generation ..." window, set parameters as shown below and click "OK".

nitial Seamline Method: Au	Itomatic	*
eamline Refining Parameters		
Segment Length (in Pixels):	100	*
Bounding Width (in Pixels):	500	4
Cost Function Weighting Facto	ors	
Pixel Value Similarity:	1	*
Direction:	1	*
Standard Deviation:	1.	

13. In the "Cutline Generation Options" window, click "OK" and close this window.

Seamline Generation Options	×
Seamline Generation Method	
Weighted Seamline	Set
🗇 Most Nadir Seamline	
🗇 Geometry-based Seamline	
Overlay-based Seamline	
Don't Ask Me This Question Again	
OK Cancel	Help

14. The Cutlines are generated automatically and displayed as shown below.



15. In the "Mosaic Tool" window, select overlapped area (frame turns to yellow) and click the following icon.

Mosecilito (M	o File)	-	-	-	-	-	_	_	1000	
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16. In case to check Seamlines, import target image.



Click on "Display raster images" icon.



Click on "Edit seams polygon " icon.



17. Draw appropriate line by "Lmb" then "double click" on the end point.



18. Seam line was modified.



19. Click this icon.



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	×
Smoothing Options:	
<ul> <li>No Smoothing</li> <li>Smoothing</li> <li>Distance: 5.000000 meters</li> </ul>	
Smoothing Filter: 🛛 🛪 Low Pass 🔹 Feathering Options:	
<ul> <li>No Feathering</li> <li>Feathering</li> </ul>	
Distance: 5.000000	
OK Cancel Help	

- 21. Click this icon in "Mosaic Tool" window.
- 22. In the "Output Image Options" window, select options and set parameters as shown below. And click "OK".

	Manual for Aerial Triangulation I
🚰 Output Image Options	
Define Output Map Area(s):	
Method: Union of All Inputs	
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Dutput Cell Sizes	ata
X: 0.30000000 × Y: 0.30000000 × met	ets 🔹
Number of Input layers: 3 Select Layers: 1:3 Use a comma (or separated list(i.e. 1,3,5) or enter ranges using a "." (i.e. 2:5). A layer may appear at most once.	
DK Cancel Help	

23. Click this icon to execute mosaicking in the "Mosaic Tool" window.



24. In the "Output File Name" window, type output file name.



25. In the "Output Options" tab, set parameters as shown below and click "OK".

Manual for Aerial Triangulation II

Outpu	it File Name				
File	Output Options				
	🔲 Output a Common Look U	ip Table			OK
	Output: 💿 All	C Selected			Cancel
0	Ignore Input Values:	0			Help
	Output Background Value:	0			
	V Stats Ignore Value:	0			Recent
	🔲 Batch Mode	1	10	Bulpule Perihab	Goto
0	MrSID G3 Subblock Size				
	Do not produce empty ou	tput images			

26. Ortho mosaicked image are generated as shown below.



**Note**: For further information of LPS, see the manuals by Leica in the following address. Installation drive¥Program Files¥Leica Geosystems **Digital Plotting** 

Manual for Digital Plotting 1

# **The Basic Theory of Digital Plotting**

### <<u>Objective></u>

Acquire the data of geographic futures on stereo viewing by using DPW (<u>Digital Photogrammetric</u> <u>W</u>orkstation).

### 1. Planning

Planning map that the work area, map quadrangle and principal points of aerial photos are drawn shall be prepared. And the time schedule shall be created under consideration of necessary date, assignment of operators, data checking system and so on.

The following items shall be considered during planning.

- A) Experience of operators (In case operators have many experiences, quality of data shall be higher and operating time shall be faster
- B) Density of settlements and roads in work area (It takes time for data acquisition in urban area than rural area)
- C) Terrain circumstance of work area (It is necessary to acquire a lot of contour data on mountainous area)
- D) Mapping scale (The way of data acquisition differ depending on the scale)

### 2. Preparation

- 2.1 Required equipments, documents and data for this work are followings.
  - A) Work planning map
  - B) Image data which were covered work area (the data format shall depend on software used)
  - C) The result of aerial triangulation (coordinate of path-points and tie-points, exterior orientation parameter)
  - D) Calibration report of camera which was used for aerial photography (value of focal length, coordinate of fiducial marks and lens distortion)
  - E) The result of field identification
  - F) The specification of data acquisition and map symbols
  - G) DPW (Digital Photogrammetric Workstation)
  - H) Library data for lines and symbols (for symbolization of plotting data)
  - I) Various documents (for control points, pipe lines, power lines and so on)

Notice : Above items which are mentioned on B), C) and D) shall be imported into DPW and stereo models shall be established. In addition, if the existing data such as a list of control points have already obtained, they shall be imported into DPW and plotted.

# 3. Digital Plotting

Data of geographic features, vegetation and terrain which are expressed onto topographic map shall be acquired in accordance with the specification of data acquisition during photo interpretation. Additionally, if field identification was carried out, the result shall be referred during plotting.

# 3.1 The order of data acquisition.

Data acquisition generally shall be conducted along the following order.

- 1). Line data which shall be bones. (road, railway, river, canal, lake, shore line, power line, pipe line and so on)
- 2). Data of buildings, small objects, land marks and plottage. (various buildings, fences, revetments, wells, various tanks, transformer stations, various towers, cemeteries and so on)
- 3). Vegetation data (rice field, crop field, orchard, various plantation, forest, bush and so on)
- 4). Terrain data (contour, cliff, spot height and so on)
- 3.2 Points to notice during digital plotting
  - 1). Operator has to appreciate the contents of the specification of data acquisition and map symbols. When items which not listed in the specification are found, it is necessary to report to manager and receive proper indications from manager.
  - 2). Road, river, pipe line, power line, contour and so on excluding supplementary contour should be continuous as a general rule.
  - 3). When field identification was carried out, data acquisition has to be carried out according to the result. If there are some doubts in the result, they shall be marked and verified in field completion.
  - 4). When the data are acquired by photo interpretation, the shapes of objects, color tone of objects, pattern of objects, shadow, height of objects, and characteristic in work area shall be considered. If it is impossible to identify any objects, they shall be verified in field completion.
  - 5). In the case of road data, the order of data acquisition shall be from high order such as 1) national road, 2) local road, 3) cart truck, 4) footpath. If cart trucks and footpaths exist adjacently, they shall be acquired in a balanced manner depending on the scale.
  - 6). In the case of the data which should be duplicate with other data such as bridge for road and bridge of railway, it should be duplicated accurately.
  - 7). In the case of acquiring the data such as limit of vegetation, it should be started from / reached to on the line data such as road and river data. And there should be no any dongle error.
  - 8). In the case of polygon data such as buildings, limit of vegetation and so on, start point and end point must be duplicated.
  - 9). In the case of acquiring building data as actual shape, neighboring buildings must be not crossed. (especially, it is necessary to pay attention in urban area)
  - 10). In the case of acquiring vegetation data, a symbol shall be located in an area.

- 11). Contour data must not intersect (especially it is necessary to pay attention in the steep area such as cliff.
- 12). Contour data of top of mountains, hills and depression is apt to be neglected. To avoid it, acquiring spot height on the top of them is effective way.
- 13). In the case of acquiring contour data of the plain, operator shall not only concentrate of cursor condition but also consider circum-terrain.
- 14). After completing digital plotting, leakage of data shall be checked on the stereo model.
- 15). When operator carry out plotting on next stereo model or next map sheet, operator must pay attention about leakage and connectivity of data.
- 16). In the case of generating of contour data from DEM, it must be checked on3D and defect data must be edited in comparison to terrain condition.

# 4. Photo Interpretation

Geographic features which came out on the photos shall be interpreted by their shapes, color patterns, shadows, height and so on. Generally, the accuracy of interpretation is higher skilled person than beginner, color image than monochrome image, large scaled photo than small scaled photo, 3D than 2D. Besides, the accuracy of interpretation will be higher if operator is familiar with characteristic of work area such as industry, weather, and religion. Generally, small objects and low height features shall be difficult to interpret.

On monochrome images, water area and wet land shall be seen dark, dry area shall be seen lightly, conifer forest shall be seen more dark than broad leaf forest.

Features	Conditions
Mosques	Minarets are identified on the buildings. And there is dome on the
	roof.
Factories	Chimneys and plants are identified with large buildings. But, small
	factories, factories without chimneys and plants are difficult to interpret.
Thermal power	A number of large chimneys and buildings are identified in the plottage
station	that is surrounded with walls and fences. Additionally, substation
	facilities exist nearby and a number of power lines shall be identified.
Hydroelectric power	A linear object which headed straight for large river shall be identified
station	(It shall be a dam). Artificial lake shall be seen on upstream of a dam.
	Large buildings that are surrounded with walls and fences shall be seen
	on downstream of a dam. Additionally, substation facilities exist
	nearby and a number of power lines shall be identified.
Airport	Air strips, taxiways, aprons shall be identified in vast plottage that is
	surrounded with walls and fences. Besides, large buildings and
	hangars shall be identified. A number of airplanes shall be identified
	on aprons.

Examples of photo interpretation (In the case of using monochrome images)

r	Manual for Digital Plotting	g _
Road	Whitish continued linear which are composed of straight and curve shall	
	be seen. Footpaths are often slightly difficult to identify because they	
	are often not continuously.	
Rail way	This is as well as road. However, this is more linear shape and has a	
	large curvature in comparison to road.	
Forest	Dense elevated woods shall be identified and surface of the ground shall	
	be difficult to see. Conifer forest looks dark and textured on the photo	
	because the tree canopy is sharp. Moreover, limit of conifer forest	
	shall be rectilinear because it is often planted.	
	Broad leaf forest looks slightly dark and smooth compared with conifer	
	forest because the tree canopy is wide.	
Cropland	Zoning by whitish linear objects such as road and blackish linear objects	
	such as canal. In case crop is not cultivated, although this looks	
	whitish as with bare land, this shall be identified by existence or	
	nonexistence of zoning. After cultivation, this looks blackish as with	
	grassland. Grassland looks smooth, meanwhile this is	
	regularly-cultivated, so that this looks textured and ridges might be	
	identified in good condition.	
Orchard	Timber is regularly-located and this limit is rectilinear, so that this shall	
	be identified easily.	
Tower	Large towers shall be identified easily in large scaled aerial photo.	
	Meanwhile, small towers and large towers in small scaled aerial photo	
	are difficult to identify but it is possible to identify this by finding its	
	shadow.	

#### 5. Schedule Control

Manager must appreciate the progress situation on the day before weekend. If the progress is delayed, discussion of countermeasure and readjustment of schedule shall be needed. Moreover, in case lengthy delays are expected, manager might increase the number of operators and make a two-shift system to complete the work within period.

#### 6. Quality Control-1

After completing of digital plotting, the data shall be printed out on the same scale with deliverable and on a size of a map quadrangle. At that time, the data shall be divided planimetric features from terrain features and be printed out. And balance of map data, mistakes of the data acquisition, leakage of data acquisition, existence or nonexistence of dangle gaps and so on shall be checked. Checked place shall be marked and lead line shall be drawn with instruction for editing on the map printed out.

If it is possible to use checking tools of GIS software for error searching and editing, the functions shall be useful and efficient.

6.1 Checking of planimetric data

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- 1). Mistakes of code number of data
- 2). Leakage of data acquisition (ortho image shall be used for background if there are no photos of field identification)
- 3). Leakage of inputting the result of field identification
- 4). Balance of data acquisition for cart tracks and footpaths
- 5). Intersecting of building data which is acquired as actual shape.
- 6). Duplicating of the data on a same line.
- 7). Existence or nonexistence of road data which is shorter than defined length in the specification.
- 8). Existence or nonexistence of river data which is shorter than defined length in the specification.
- 9). Existence or nonexistence of vegetation data which is smaller than defined size in the specification.
- 10). Existence or nonexistence of unknown area by leakage of vegetation symbol.
- 11). Existence or nonexistence of dangles and gaps.

#### 6.2 Checking of terrain data

- 1). Mistakes of code number of data.
- 2). Leakage of data acquisition
- 3). Elevation value of contour data (existence or nonexistence of broken number)
- 4). The number of principal contours between index contours
- 5). Intersecting of contour data
- 6). Condition of data acquisition of supplementary contour
- 7). Consistency of elevation value among contour, spot heights and control points
- 8). Balance of data acquisition of spot heights
- 9). Existence or nonexistence of dangles and gaps

#### 7. Revision Plotting

Digital plotting shall be conducted again to modify errors when errors are founded in <Quality control -1>.

#### 8. Quality Control-2

After completing above-mentioned revision plotting, modified items shall be checked again. If there are still errors, revision plotting and checking shall be repeated until there is no any error.

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# 1. Create a project file

(1). To launch the LPS, double click this icon or select Leica photogrammetry Suite from the Windows program



(2). The "Project Manager" window appears.



- (3). To open a block file (*.blk), click the following icon.
- (4). Select the appropriate block file which completed aerial triangulation and click "OK"

õ

File	
Look in: 🔄 TT	- 🖻 😤 🕷
i mosaic	OK.
🔜 ortho 🕷 att test.blk	Cancel
📕 gitega_at.blk	Help
🔝 gitega_dem.blk	
itega_test.blk	Becent
plot_setting.blk	
temp.blk	[1010
File name: plot_setting.blk	
Files of type: [] PS Block File (* blk)	

(5). The footprints of aerial photos are displayed. And check column of 'Pyr', 'Int', 'Ext' and 'Online'. These 3 columns should be filled wirth green color in order to conduct digital plotting.

File Edit Process Tool	s Help								
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	5	90366		d://project_trainning/at/images/gitega/burundi_9_0366.tif	4				
	6	90367		d://project_trainning/at/images/gitega/burundi_9_0367.tif	4				
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(6). To start digital plotting, click this icon. And launch "Pro600" software.



(7). The "PRO600 Project Manager" appears. If a project file for PRO600 has already made, select appropriate one.

File Directory		
Files:	Directories:	
gitega_5k.prj	\Digtal_Plotting\	Open
burundi_25k.prj	D:\	Exit
gitega_5k.prj	Project_Trainning	
	Bujumbura_30cm	New
	Bujumbura_50cm	
	Bujumbura_plot_5k	<u>D</u> elete
	Man Symbols	
	plot_25k	
List Elles of Turner	Disus	-

(8). If a project file for PRO600 has not made yet, click "New" in the "PRO600 Project Manager" window.



(9). Type a new project file name in "New PRO600 Project" window. And click "OK".

Directory	
Files:	Directories:
test.prj	D:\!Project_Trainning\Digtal_Plotting\
burundi "25k.prj gitega_5k.prj	DA     DA     Project_Trainning     Digtal_Plotting     Bujumbura_30cm     Bujumbura_50cm     Bujumbura_plot_5k     Cell     Map_Symbols     plot_25k
File <u>Type</u> :	Drives:
PRO600 Projects [*.prj]	▼ (D: View Pielp
Show File Icons	
Seed File C:\ProgramData\ERDAS\PRO6	00\projseed\ Select

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(10). After click "OK", the "PRO600 Project" window appears. Click "Add/Remove Files..." to add MicroStation design files (*.dgn) on the "Design flies" tab. These files shall be created in advance and contain all of necessary layers.

Design files	Project files	Project parameters	Initial view	Tolerances	T E
File name	1			d/Remove File	
				<u>D</u> elete File	
		Cause Destinat		Canaal	1

(11). Select MicroStation design files which were prepared in advance. And click "Add".

Files:	Directories:	
Burundi_gitega_5k.dgn	D:\!Project_Trainning\Digtal_Plotting\	
Burundi_25000_symbol.dgn Burundi_25k_3D_Template.dgn Burundi_5k_3D_Template.dgn Burundi_gitega_5k.dgn Burundi_gitega_5k_0308.dgn Burundi_gitega_5k_0810dgn.dgn Burundi_gitega_5k_0827.dgn Burundi_TT.dgn explode_Burundi_symbol.dgn	D:\ Project_Trainning Digtal Plotting Bujumbura_30cm Bujumbura_50cm Bujumbura_plot_5k. Cell Map_Symbols plot_25k	Done
List Files of Type:	Drives:	Cancer
*.dgn	• 🗇 D: •	Help
Files in project		
		Add
		Remove

(12). Click "Add", and then click "Done".

(13). MicroStation design file selected are listed as shown below.

)esign files	Project files	Project parameters	Initial view	Tolerances
File name				_
\Digtal_F	Plotting\Burund	li_gitega_5k.dgn	Ad	d/Remove File
				Delete File

(14). Go to the "Project files" tab in the "PRO600 Project" window.

Design files   Project	t files Project parameters Initial view Tolerances
PRO600 Library	y\ERDAS\PRO600\library\DemoV8.rsc
Cell Library	\ERDAS\PRO600\library\DemoLibV8.cel
DGN Seed File	\ERDAS\PRO600\dgnseed\SeedMet3d.dgn
Ground Points	

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(15). If a PRO600 Library (*.rsc) file of the project has already prepared, it can be selected here as shown below.

PR0600 Library

File Directory	
Files: Burundi_gitega_5k.rsc	Directories: \ERDAS\PRO600\library\
Burundi_gitega_5k.rsc DemoV8.rsc	C:\ ProgramData ERDAS PRO600 Pibrary
List Files of Type:	Drives:

Design files	Project files	Project parameters Initial view Tolerances
PROG	00 Library	\ERDAS\PRO600\library\Burundi_gitega_5k.rsc
Cell	Library	\ERDAS\PRO600\library\DemoLibV8.cel
DGN S	Seed File	\ERDAS\PRO600\dgnseed\SeedMet3d.dgn
Groun	d Points	

(16). If a PRO600 Library (*.rsc) file of the project has not prepared yet, default setting is adopted here as shown below.

Design files   Project files	Project parameters Initial view Tolerances
PRO600 Library	\ERDAS\PRO600\library\DemoV8.rsc
Cell Library	\ERDAS\PRO600\library\DemoLibV8.cel
DGN Seed File	\ERDAS\PRO600\dgnseed\SeedMet3d.dgn
Ground Points	

(17). Click "Cell Library" to select a cell library file (*.cel). A cell library file for the project must be prepared in advance.

<u>C</u> ell Library
----------------------

(18). After selecting a cell library file prepared in advance, click "OK".

Directories:	
D:\!Project_Trainning\Digtal_Plotting\	
Digtal_Plotting  Digtal_Plotting  Bujumbura_30cm  Bujumbura_50cm  Dujumbura_plot_5k  Cell  Map_Symbols  plot_25k	
	<u>O</u> K
Drives:	Cancel
	Directories: D:\!Project_Trainning\Digtal_Plotting\ D:\ Project_Trainning Digtal_Plotting Bujumbura_30cm Bujumbura_50cm Bujumbura_plot_5k Cell Map_Symbols plot_25k Drives:

(19). Go to the "Project parameters" tab in "PRO600 Project" window. And input "Mapping scale" and "Contour interval" as follow as plotting specification.

Design files Project files	Project parameters	Initial view	Tolerances	3
Mapping scale:	5000			
<u>C</u> ontour interval:	2.500			
Units	Metric 💌			

(20). Go to the "Initial view" tab in the "PRO600 Project" window. Set a parameter as shown below.

Design files	Project files	Project parameters	Initial view	Tolerances	1 1
	Start online	e to stereoplotter			
	Apply initia				
	Scale:	5000			

(21). Go to the "Tolerances" tab in the "PRO600 Project" window. And input the values as shown below. Although values are input here as shown below, they can be changed afterword if values are not satisfied with condition of plotting work.

Design files	Project files	Projec	t parameters	Initial view	Tolerances	. A
9	Snap radius:	2.000	-			
	Sguaring:	3.000				
					-	-

(22). Go to the "Stream parameters" tab in the "PRO600 Project" window. Values of stream parameters affect smoothness of counter data during plotting. Although values are input here as shown below, they can be changed afterword such as the following second image if the values are not satisfied with smoothness of counter data.

Project parameters In	itial view	Tolerances	Stream parameters	4.10
Delta	: 2.000			
<u>T</u> olerance	: 20.000	1		
Angle	: 30.000	1		
Area	: 20.000	1		
Corres DON Dis		Cours Design		-

(23). When the settings in "PRO600 Project" are complete, click "Save Project".

(24). Go back to the "Design files" tab in the "PRO600 Project" window. Select a design file (*.dgn) and click "Open DGN File".

Design files	Project files	Project parameters	Initial view	Tolerances	*
File name	-				
\Digtal_F	lotting\Burund	li_gitega_5k.dgn	A	dd/Remove File	in ]
				Delete File	
[		Crus Brainst		Cancel	_

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# 2. Create a Library Catalog

(1). The "MicroStation" and "Leica Photogrammetry Suite – PRO600" are launched.



(2). On the default, contents of "Library Catalog" are as shown below.

📕 Lil	brary Catalog (De 💼 😐 🗾
1	PAVED ROAD
2	SIDEWALK
3	FOOTPATH
4	TRACK
5	FREEWAY
13	EMBANKMENT
14	RAILROAD
15	TRAMWAY
21	ELECTRIC LINE
30	FENCE
64	HEDGE
70	ROAD/PAVEMENT, CENTERLINE
71	ROAD EDGE/PAVEMENT
80	TREE OUTLINE
90	STORAGE TANKS
100	RIVER
101	STREAM
102	CANAL
103	POND
104	LAKE
106	STORM DRAIN
107	DRAIN
108	RESERVOIR
109	DAM
120	CONTOUR, INDEX 🔻
	<u>E</u> dit
	,

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(3). On the other hand, contents of "Library Catalog" for the project are as shown below.

<mark> (</mark>	Libr	ary Catalog (Burundi-5k.cat) 💼 🔳	×
	001		
	1001	Border	<u>_</u>
	1002	Boundary of Province and Bujunmbura City	
	1003	Boundary of Commune	
	1004	Boundary of Quartier or Colline	
	1005	Boundary of Sub-colline	
4	2001	Asphalt-paved road that is 2.5m or more in widt	
	2002	Paved road more than 2.5m in width	
4	2003	Unpaved road more than 2.5m in width	
	2004	Unpaved road less than 2.5m in width	
	2005	Practicable road less than 2.5m in width (punis	=
	2006	Road under construction more than 5m in widt	
4	2007	Foot path	
4	2008	Median strip and rotary(more than 2.5m in width	
	2009	Median strip less than 2.5m in width	
1	2010	Bridge for vehicles	
	2011	Light bridge(footbridge)	
1	2012	Culvert	
1	2101	Asphalt-paved road?Center line) for GIS	
1	2102	Paved road (Center line) for GIS	
1	2103	Unpaved road (Center line) for GIS	
	3001	Multi-sroty building more than 10m in long side	
	3002	One-sroty building more than 10m in long side	
	3003	Warehouse more than 10m in long side	
1	3004	Hangar(more than 10m in long side)	
13	3005	Building less than 10m in long side	
13	3006	Builing under construction more than 10m in lor	
13	3007	Ruined builiding more than 10m in long side	
	3008	Courtyard	
13	3101	Mosque(more than 10m in long side)	
1	3102	Mosque less than 10m in long side	
13	3103	Catholic church(more than 10m in long side)	
13	3104	Catholic church less than 10m in long side	
	3105	Protestant church(more than 10m in long side)	
	3106	Protestant church less than 10m in long side	
13	3107	Catholic parish(more than 10m in long side)	
	3108	Catholic parish less than 10m in long side	
1	3109	Primary school(more than 10m in long side)	
1	3110	Primary school less than 10m in long side	
1	3111	Junior high school (more than 10m in long side)	
1	3112	Junior high school less than 10m in long side	
1	3113	High school(more than 10m in long side in the :	
1	3114	High school less than 10m in long side	
1	2115	I Iniversitu/more than 10m in long eide in the eit.	

(4). To make a Library Catalog for the project, select **PRO600** > **Library** > **New...** in the MicroStation menus.



(5). The "Create PRO600 Library" window appears. Type a new file name and click "OK".



(6). The "PRO600 Library Manager" window appears. Click "Create".

ype Code Level Color Style Weight Description Properties	Size

(7). The "PRO600 Create Library Entries" window appears.

PRO600 Create Library I	Entries
Text codes from:	to:
Cell codes from:	to:
Line codes from:	to:
Shape codes from:	to:
MultiLine codes from:	to:
<u> </u>	Cancel

# 2.1. Point Library

(1). This is case of point data. Type the code number of geographic features which should be acquired on row of "Cell codes from:" as shown below. And click "OK".

PRO600 Create Library	Entries
Text codes from:	to:
Cell codes from:	4111 to: 4114
Line codes from:	to:
Shape codes from:	to:
MultiLine codes from:	to:
<u>O</u> K	Cancel

(2). The contents of "PRO600 Library Manager" shall be displayed as shown below. Click "Edit" for modification.

Soft b	y: (Lod	e number		Units:	Metric	Scale:	5000	
Type	Code	Level	Color	Style	Weight	Description	Properties	Size
Cell	4111	Default	ByLvl	ByLvi	ByLvi	NewEntry		1.0
Cell	4112	Default	ByLvl	ByLvi	ByLvi	NewEntry		1.0
Cell	4113	Default	ByLvl	ByLvl	ByLvt	NewEntry		1.0
Cell	4114	Default.	ByLvi	ByLvi	ByLvI	NewEntry		1.0

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(3). In the "PRO600 Symbol Definition" window, type the description such as feature's name at "Description:". Type command as "Collect Symbols" at "Command:". Select the same number with code number at "Level". "Collect Symbols" command is generally used for data acquisition of point data.

Code:         4111         Autosnar           Description:         NewEntry           Command:         Collect Symbols           Level         Default         T           Color:         4104         4105           Style:         4105         4106           Weight:         4107         4108           Gell name:         4109         4109           Scale:         4111         E	As is Match
Description         NewEntry           Command:         Collect Symbols           Level:         Default         ▼           Color:         4104         ▲           Style:         4105         ↓           Weight:         4106         ↓           Symbol attribut         4108         ↓           Gell name:         ↓         ↓           Scale:         ↓         ↓	Match
Command:         Collect Symbols	Match
Level         Default         ▼           Color:         4104         *           Syle:         4105         *           Weight         4106         *           Symbol attribut         4108         *           Cgil name:         4111         E	Match
Color:         4104           Style:         4105           4106         4107           Symbol attribut         4108           4109         4109           Cgll name:         4111	
Style:         4105           406         4106           Weight:         4107           Symbol attribut         4108           4109         4109           Cgil name:         4111           Scale:         4111	
4106 Weight: 4107 Symbol attribut Cgll name: 4110 Scale: 4111 E	
Image         4107           Symbol attribut         4108           Cell name:         4100           Scale:         4111	
Symbol attribut 4108 Cell name: 4110 Scale: 4111	
Cell name: 4109 4110 Scale: 4111	
Scale: 4111	
and the second s	
Rotation: 4112	
A113	
Helative to: 4114	
Text code: 4115	
Levelmoder 4116 pot	neight code
4117	
4118 -	

Common attrib	utes	
Code:	4111	Autosnap: As is
Description:	NewEntry	
Command:	Collect Symbols	
Level:	4111	<ul> <li>Match</li> </ul>
Color:	ByLevel	•
<u>Style:</u>	(0) ByL	e) 💌
Weight:	(4) ByL	e) 🔻
Symbol attribu	tes	
Cell name:		
C <u>el</u> l name: Scale:	1.00	
C <u>el</u> l name: Scale: Ro <u>t</u> ation:	1.00	
C <u>el</u> l name: Scale: Ro <u>t</u> ation: <u>R</u> elative to:	1.00 0.00 Ground X	
C <u>el</u> l name: Scale: Ro <u>t</u> ation: <u>R</u> elative to: Te <u>xt</u> code:	1.00 0.00 Ground X 0	

(4). Type the number which was registered in the cell library file (*.cel) at "Cell name:" under "Symbol attributes". The symbol which is registered in the cell library file (*.cel) shall be displayed as shown below.



- (5). After complete, click "Save" or "Next"
- (6). After click "Save", the "PRO600 Library Manager" shall be displayed as shown below.

Туре	Code	Level	Color	Style	Weight	Description	Properties	Size
Cell	4111	4111	ByLvl	ByLvl	ByLvl	Antenne	4111	1.0
Cell	4112	Default	ByLvl	ByLvI	ByLvl	NewEntry		1.0
Cell	4113	Default	ByLvl	ByLvl	ByLvl	NewEntry		1.0
Cell	4114	Default	ByLvl	ByLvi	ByLvl	NewEntry		1.0
(7). Same progress shall be carried out for others as shown below.

II and	0.000.1.11									00
PA PRO	0600 Lib	orary Mar	nager							23
File	Edit	<u>R</u> esource	es Cat	ta <u>l</u> og						
Libra	ary:\E	RDAS\P	RO600\	library\B	urundi_s	ample.rsc				
<u>S</u> ort b	by: Cod	e number	•	<u>U</u> nits:	Metric	▼ S	c <u>al</u> e: 5000			
Type	Code	Level	Color	Style	Weight	Description	n	Properties	Size	
Cell	4111	4111	ByLvl	ByLvl	ByLvl	Antenne		4111	1.0	
Cell	4112	Default	ByLvl	ByLvl	ByLvl	Phare		4112	1.0	
Cell	4113	Default	ByLvl	ByLvl	ByLvl	Feu		4113	1.0	
Cell	4114	Default	ByLvl	ByLvl	ByLvl	Grue		4114	1.0	
_										
	<u>E</u> dit		Find		Cre	ate	<u>D</u> elete		D <u>o</u> ne	

(8). In the case of necessary to give rotation against symbol during plotting work such as small buildings, tower for power line and so on, command at "Command:" in the "PRO600 Symbol Definition" window.

ዞ pro	600 Lib	orary Mar	ager						x
<u>F</u> ile	Edi <u>t</u>	<u>R</u> esource	s Cat	ta <u>l</u> og					
Librar	y:\E	RDAS\P	RO600\	library\B	urundi_sa	ample.rsc			
<u>S</u> ort b	y: Cod	e number	•	<u>U</u> nits:	Metric	▼ Scale:	5000		
Type	Code	Level	Color	Style	Weight	Description	Properties	Size	
Cell	3005	Default	ByLvl	ByLvl	ByLvl	Petit batiment	3005	1.0	
Cell	4111	4111	ByLvI	ByLvI	ByLvl	Antenne	4111	1.0	
Cell	4112	Default	ByLvl	ByLvl	ByLvl	Phare	4112	1.0	
Cell	4113	Default	ByLvl	ByLvl	ByLvl	Feu	4113	1.0	
Cell	4114	Default	ByLvl	ByLvl	ByLvl	Grue	4114	1.0	
	<u>E</u> dit		Find		Crea	ate [	<u>)</u> elete	Done	

(9). The command for giving rotation to symbol is "Collect Symbols Rotated" as shown below.

PRO600 Syr	nbol Definition 📃 📼 💌
Common attrib	utes
Code:	3005 Autosnap: As is 🔻
Description:	Petit batiment
Command:	Collect Symbols Rotated
Level:	Default  Match
<u>C</u> olor:	ByLevel
<u>Style:</u>	(0) ByLer 🔻
Weight:	(0) ByLet 🔻
Symbol attribut	tes
Cell name:	3005
Scale:	1.00
Rotation:	0.00
Relative to:	Ground X 🔹
Text code:	0
Level mode:	Relative
Next	Prev Save Cancel

## 2.2. Line Library

(1). In case of create Line Library, Click "Create" in the "PRO600 Library manager" then "Pro600 Create Library Entries" window appears. Type the code number of geographic features which should be acquired on row of "Line codes from:" as shown below. And click "OK".

PRO600 Create Library I	Entries		
Text codes from:		te	p:
Cell codes from:		te	p:
Line codes from:	2004	t	2007
Shape codes from:		te	p:
MultiLine codes from:		te	p:
<u>O</u> K		Car	ncel

(2). The Contents of "PRO600 Library Manager" shall be displayed as shown below. To edit the content of each library, click "Edit".

🔑 pro	600 Lib	rary Man	nager					• ×
<u>F</u> ile	Edi <u>t</u>	<u>R</u> esource	es Cat	a <u>l</u> og				
Librar	Library:\ERDAS\PRO600\library\Burundi_sample.rsc							
Sort by	r: Code	e number	•	<u>U</u> nits:	Metric	▼ Scale:	5000	
Type	Code	Level	Color	Style	Weight	Description	Properties	Size
Line	2004	Default	ByLvl	ByLvl	ByLvl	NewEntry		
Line	2005	Default	ByLvI	ByLvl	ByLvl	NewEntry		
Line	2006	Default	ByLvl	ByLvl	ByLvl	NewEntry		
Line	2007	Default	ByLvl	ByLvl	ByLvl	NewEntry		
Cell	3005	Default	ByLvl	ByLvl	ByLvl	Petit batiment	3005	1.0
Cell	4111	4111	ByLvl	ByLvl	ByLvl	Antenne	4111	1.0
Cell	4112	Default	ByLvl	ByLvl	ByLvl	Phare	4112	1.0
Cell	4113	Default	ByLvl	ByLvl	ByLvl	Feu	4113	1.0
Cell	4114	Default	ByLvl	ByLvl	ByLvl	Grue	4114	1.0
	<u>E</u> dit		Find		<u>C</u> rea	ate [	Delete	Done

(3). In the "PRO600 Line Definition" window, type the description such as feature's name at "Description:". Type command "Collect Strings" at "Command:". Select the same number with code number at "Level". "Collect Strings" command is generally used for data acquisition of line data.

John of attri	ules .	1.1		
Code:	2004	Au	tosnap:	Asis
Description:	Route non-rev	retue		
Command:	Collect Strings			
Level:	2004	٠.	1	Match
<u>C</u> olor:	ByLevel		-	
Style:	(0)	ByLe 🔻	Scale	1.05
Weight:	(0)	ByLet 💌		
ine attributes				
Cell code:	0		Co	ntour code
Pattern:	Unscaled	<b>x</b> in:	Space	(3D) 🔻

(4). Same progress shall be carried out for others as shown below.

Sort b	y: Cod	e number	-	<u>U</u> nits:	Metric	Scale: 5	000	
Туре	Code	Level	Color	Style	Weight	Description	Properties	Size
Line	2004	2004	ByLvl	ByLvl	ByLvl	Route non-revetue	£	
Line	2005	2005	ByLvl	ByLvl	ByLvi	Piste		
Line	2006	2006	ByLvl	ByLvl	ByLvl	Rpute en construc	tion	
Line	2007	2007	ByLvl	ByLvl	ByLvl	Sentier		
Cell	3005	Default	ByLvl	ByLvl	ByLvl	Petit batiment	3005	1.0
Cell	4111	4111	ByLvl	ByLvl	ByLvl	Antenne	4111	1.0
Cell	4112	Default	ByLvl	ByLvl	ByLvl	Phare	4112	1.0
Cell	4113	Default	ByLvl	ByLvl	ByLvl	Feu	4113	1.0
Cell	4114	Default	ByLvl	ByLvl	ByLvl	Grue	4114	1.0

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#### 2.3. Polygon Library

(1). This is case of polygon data. Type the code number of geographic features which should be acquired on row of "Shape codes from:" as shown below. And click "OK".

PRO600 Create Library I	Intries		
Text codes from:		to:	
Cell codes from:		to:	
Line codes from:		to:	
Shape codes from:	3006	to:	3008
MultiLine codes from:		to:	
<u>O</u> K		Cance	el

(2). The Contents of the "PRO600 Library Manager" shall be displayed as shown below.

Librar	y:\E	ERDAS	R0600\	library\B	lurundi_sa	ample.rsc			
Sort by	y: Cod	e number	•	<u>U</u> nits:	Metric	▼ Sc <u>a</u> le: 5	000		
Туре	Code	Level	Color	Style	Weight	Description	Properties	Size	1
Line	2006	2006	ByLvI	ByLvl	ByLvl	Rpute en construct	ion		
Line	2007	2007	ByLvl	ByLvl	ByLvl	Sentier			÷
Cell	3005	Default	ByLvI	ByLvl	ByLvi	Petit batiment	3005	1.0	
Shape	3006	Default	ByLvI	ByLvl	ByLvl	NewEntry			
Shape	3007	Default	ByLvl	ByLvl	ByLvl	NewEntry			
Shape	3008	Default	ByLvl	ByLvl	ByLvl	NewEntry			-
Cell	4111	4111	ByLvl	ByLvl	ByLvl	Antenne	4111	1.0	
Cell	4112	Default	ByLvI	ByLvl	ByLvl	Phare	4112	1.0	
Cell	4113	Default	ByLvI	ByLvl	ByLvI	Feu	4113	1.0	
Cell	4114	Default	ByLvI	ByLvl	ByLvI	Grue	4114	1.0	

(3). In the "PRO600 Shape Definition" window, type the description such as feature's name at "Description:". Type command "Collect Squared" at "Command:". Select the same number with code number at "Level". "Collect Squared" command is generally used for data acquisition of polygon data such as buildings.

Common attrib	outes			
Code:	3006	Auto	snap: [	As is
Description:	Batiment en cha	antier		
Command:	Collect Squared			
Level:	3006	•	-	Match
Color:	ByLevel		-	
Style:	( (3) B	yLen 🔻	Scale	1.05
<u>S</u> tyle: <u>W</u> eight:	(0) B	yLen ▼ yLen ▼	Scale	1.00
<u>S</u> tyle: <u>W</u> eight: Shape attribut	( (3) B ( (0) B tes	yLei ▼ yLei ▼	Scale	1.00
<u>Sty</u> le: <u>W</u> eight: Shape attribut <u>Fi</u> ll:	( (3) B ( (0) B tes (None	yLen ▼ yLen ▼.)	Scale •	1.00
<u>S</u> tyle: <u>W</u> eight: Shape attribut <u>Fill:</u> Angle <u>1</u>	(3) B (	yLer ▼] yLer ▼] Angle	Scale	1.00
<u>S</u> tyle: <u>W</u> eight: Shape attribut <u>Fill:</u> Arigle <u>1</u> : Spacing	(3) 8 (0) 8 (0) 8 (0) 8 (0) 9 (0) 8 (0) 9 (0) 8 (0) 9 (0) 8 (0) 9 (0) 9	yLet ▼ yLet ▼ Angle Fill og	Scale 2. 0.0 or	000

<u>F</u> ile	Edi <u>t</u>	<u>R</u> esource	es Cat	a <u>l</u> og					
Library	/:\E	RDAS\P	RO600\	ibrary\B	urundi_sa	ample.rsc			
Sort by	r: Cod	e number	•	<u>U</u> nits:	Metric	▼ Scale: 5000			
Туре	Code	Level	Color	Style	Weight	Description	Properties	Size	
Line	2006	2006	ByLvl	ByLvl	ByLvl	Rpute en construction			
Line	2007	2007	ByLvl	ByLvl	ByLvl	Sentier			
Cell	3005	Default	ByLvl	ByLvl	ByLvl	Petit batiment	3005	1.0	
Shape	3006	3006	ByLvl	ByLvl	ByLvl	Batiment en chantier			
Shape	3007	3007	ByLvl	ByLvl	ByLvl	Batiment en ruine			
Shape	3008	3008	ByLvl	ByLvl	ByLvl	Cour			=
Cell	4111	4111	ByLvl	ByLvl	ByLvl	Antenne	4111	1.0	
Cell	4112	Default	ByLvl	ByLvl	ByLvl	Phare	4112	1.0	
Cell	4113	Default	ByLvl	ByLvl	ByLvl	Feu	4113	1.0	
Cell	4114	Default	ByLvl	ByLvl	ByLvl	Grue	4114	1.0	Ŧ
	<u>E</u> dit		Find		<u>C</u> rei	ate <u>D</u> elete		D <u>o</u> ne	

(4). Same progress shall be carried out for others as shown below.

(5). In the case of polygon data but not squared such as lake, the command is different from above mentioned case. The following "5101" indicates lake's code number.

PRO600 Create Library B	Entries	
Text codes from:		to:
Cell codes from:		to:
Line codes from:		to:
Shape codes from:	5101	to:
MultiLine codes from:		to:
<u>O</u> K	C	Cancel

(6). In the "PRO600 Shape Definition" window, type the description such as feature's name at "Description:". Type command "Collect Shapes" at "Command:". Select the same number with code number at "Level". "Collect Shapes" command is generally used for data acquisition of polygon data such as area.

A PRO600 Sh	ape Definition	L	= E X										
Common attrib	outes												
Code:	5101	Autosna	p: Asis 🔻										
Description:	Lac, Etang, mare												
Command:	Collect Shapes												
Level:	5101	¥.	Match										
Color:	ByLevel	*	matery	M PRO	600 Lik	Far Mar	iager				1 mil	一回	1 23
Style	(0) Byl	et T Se	ale (1.00. ]	Eile.	Edit	Permure	- 04	talog			100	-	1
Weight	(d) 0) 0		and the state of the	The	cait	Mesource	is Ca	taiog	_				_
Weight	(1) byc	C. A.		Librar	/i\I	ERDAS	R0600/	library \E	lurundi_sa	ample.rsc			
Shape attribut	tes			Sort b	V: Coo	e number	-	Units:	Metric	<ul> <li>Scale: 500</li> </ul>	0		
<u>E</u> II:	None	*		-		1					-	1	-
Angle 1	0.0000	Angle2	0.0000	Type	Code	Level	Color	Style	Weight	Description	Properties	Size	*
Spacing:	1.0000	Fill color:	0 *	Line	2007	2007	ByLvl	ByLvI	ByLvi	Sentier			
Lina code;	0	Area:	Solid 💌	Cell	3005	Default	ByLvl	ByLvl	ByLvl	Petit batiment	3005	1.0	
				Shape	3006	3006	ByLvI	ByLvi	ByLvI	Batiment en chantier			
Next	Prev	Save	Cancel	Shape	3007	3007	ByLvl	ByLvl	ByLvI	Batiment en ruine			
	<u>дат</u> )	oote	- <u> </u>	Shape	3008	3008	ByLvl	ByLv	ByLvl	Cour	mark.		- 13
				Cell	4111	4111	ByLvl	ByLvi	ByLyl	Antenne	4111	1.0	Ð
				Cell	4112	Default	ByLvI	ByLvi	ByLvI	Phare	4112	1.0	
				Cell	4113	Default	ByLv	ByLvl	ByLvl	Feu	4113	1.0	
				Cell	4114	Default	ByLvl	ByLvl	ByLvi	Grue	4114	1.0	1
				Shape	5101	5101	ByLvI	ByLvi	ByLVI	Lac. Etang. mare			T
				-	F 14	1 1	P.4	_	10		1.0		-
					Fait		Find		Lie	ate Delete		Done	100

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#### 2.4. Contour Library

(1). In the case of contour data, even if it shall be acquired as line data, the command is different from normal line data.

PRO600 Create Library I	Entries
Text codes from:	to:
Cell codes from:	to:
Line codes from:	7101 to 7103
Shape codes from:	to:
MultiLine codes from:	to:
<u>O</u> K	Cancel

Library	y:\E	RDAS	R0600\	library\B	urundi_sa	ample.rsc		
Sort by	y: Cod	e number	•	<u>U</u> nits:	Metric	▼ Scale: 50	00	
Туре	Code	Level	Color	Style	Weight	Description	Properties	Size
Shape	3007	3007	ByLvl	ByLvl	ByLvl	Batiment en ruine		
Shape	3008	3008	ByLvl	ByLvI	ByLvI	Cour		
Cell	4111	4111	ByLvI	ByLvi	ByLvl	Antenne	4111	1.0
Cell	4112	Default	ByLvl	ByLvI	ByLvl	Phare	4112	1.0
Cell	4113	Default	ByLvl	ByLvI	ByLvI	Feu	4113	1.0
Cell	4114	Default	ByLvI	ByLvl	ByLvl	Grue	4114	1.0
Shape	5101	5101	ByLvl	ByLvl	ByLvl	Lac, Etang, mare		
Line	7101	Default	ByLvl	ByLvI	ByLvl	NewEntry		
Line	7102	Default	ByLvl	ByLvl	ByLvl	NewEntry		
Line	7103	Default	ByLvl	ByLvI	ByLvl	NewEntry		

(2). In the "PRO600 Line Definition" window, type the description such as feature's name at "Description:". Type command "Collect Strings Stream" at "Command:". Select the same number with code number at "Level". "Contour code" under "Line attributes" is checked out.

Common attrib	outes		
Code:	7101	Aut	osnap: As is
Description:	Courbe maitresse	e	
Command:	Collect Strings St	tream	
Level:	7101	•	Match
Color	ByLevel	*	- described
<u>Style:</u>	(0) By	Les -	Scale 1.00
Weight:	(0) By	Lei T	
Line attributes			
Cell code:	0		Contour code
Pattern	Unscaled •	in:	Space (3D) -

Libran	/=\E	RDAS	R0600\	library/B	urundi_sa	ample.rsc			
Sort by	: Cod	e number		<u>U</u> nits:	Metric	▼ Scale: 500	0		
Туре	Code	Level	Color	Style	Weight	Description	Properties	Size	1
Shape	3007	3007	ByLvl	ByLvl	ByLvl	Batiment en ruine			
Shape	3008	3008	ByLvi	ByLvi	ByLvl	Cour			
Cell	4111	4111	ByLvl	ByLvl	ByLvl	Antenne	4111	1.0	
Cell	4112	Default	ByLvl	ByLvl	ByLvI	Phare	4112	1.0	E
Cell	4113	Default	ByLvi	ByLvi	ByLvl	Feu	4113	1.0	
Cell	4114	Default	ByLvl	ByLvl	ByLvt	Grue	4114	1.0	14
Shape	5101	5101	ByLvt	ByLvl	ByLvI	Lac, Etang, mare		-	=
Line	7101	7101	ByLvI	ByLvI	ByLvl	Courbe maitresse			
Line	7102	7102	ByLvi	ByLyl	ByLvl	Courbes nomiale			
Line	7103	7103	ByLyl	ByLyl	ByLyl	Courbe intermediaire			

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#### 2.5. Spot height Library

(1). In the case of spot height, it is different from normal point data because it needs a text code library which shows elevation value. Before spot height is set, the text code shall be created in advance. Here, "7404" which is unused for others is used for the text code.

RO600 Create Library B	Entries	
Text codes from:	9999	to:
Cell codes from:		to:
Line codes from:		to:
Shape codes from:		to:
MultiLine codes from:		to:
<u>O</u> K		Cancel

(2). After the text code is created, library for spot height is created as shown below.

D

RO600 Create Library E	Entries	
Text codes from:		to:
Cell codes from:	7304	to:
Line codes from:		to:
Shape codes from:		to:
MultiLine codes from:		to:
<u>O</u> K		Cancel

(3). In the "PRO600 Symbol Definition" window, type the description such as feature's name at "Description:". Type command "Collect Symbols" at "Command:". Select the same number with code number at "Level". "Spotheight code" under "Symbol attributes" is checked out. And "9999" is typed in "Text code:" under "Symbol attributes".

	7004	
Lode:	7304 Autos	inap (As is
Description:	Poins cotes	
Command:	Collect Symbols	
Level:	7304 🔻	Match
Color:	ByLevel 🔹	1
Style:	(0) ByLer •	
Weight:	(1) ByLer +	
ymbol attribu	ites	
Cell name:	7304	
Scale:	1.00	10
Rotation:	0.00	( )
Relative to:	Ground X 💌	
	0000	
Text code:	2222	

(4). Open the "PRO600 Text Definition" window for "9999" and type the description such as feature's name at "Description:". It is unnecessary to type at "Command:". Select the code number of spot height at "Level". Some settings such as "Font:" under "Text

attributes" shall be set as shown below. And click "Save".

Johnmon auni	outes
Code:	9999 Autosnap: As is
Description:	Points cotes
Command:	
Level:	7304 • Match
Color:	ByLevel 🔹
<u>Style:</u>	(0) ByLer 🔻
Weight:	(1) ByLer 🔻
ext attributes	8
Eont:	3 ENGINEERING -
Height:	10.00 Width: 10.00
Justification:	Left bottom
Rotation:	0.00 to Ground X 💌
Line 1:	Z coordinate
Line 2:	No annotation   No decimals
	No annotation   No decimals
Line 3:	No apportation
Line <u>3</u> : Line <u>4</u> :	(no dimolation +) (no decimala

Click "Done" after return to "PRFO600 Library Manager".

ዞ pro	600 Lib	orary Man	ager						X
File	Edi <u>t</u>	<u>R</u> esource	s Cat	a <u>l</u> og					
Libran	y:\E	)igital Edit	ting\man	iuals\Bu	ırundi sa	mple.rsc			
<u>S</u> ort by	y: Cod	e number	•	<u>U</u> nits:	Metric	✓ Sc <u>al</u> e: 500	D		
Type	Code	Level	Color	Style	Weight	Description	Properties	Size	
Cell	4111	4111	ByLvl	ByLvl	ByLvl	Antenne	4111	1.0	
Cell	4112	Default	ByLvl	ByLvI	ByLvl	Phare	4112	1.0	
Cell	4113	Default	ByLvl	ByLvl	ByLvl	Feu	4113	1.0	
Cell	4114	Default	ByLvl	ByLvl	ByLvl	Grue	4114	1.0	
Shape	5101	5101	ByLvl	ByLvl	ByLvl	Lac, Etang, mare			
Line	7101	7101	ByLvl	ByLvl	ByLvl	Courbe maitresse			
Line	7102	7102	ByLvl	ByLvl	ByLvl	Courbes normale			=
Line	7103	7103	ByLvl	ByLvl	ByLvl	Courbe intermediaire			
Cell	7304	7304	ByLvl	ByLvl	ByLvl	Poins cotes	7304	1.0	
Text	9999	7304	ByLvl	ByLvl	ByLvl	Points cotes	Z	10.0,10.	Ŧ
	<u>E</u> dit		Find		<u>C</u> rea	ate <u>D</u> elete		D <u>o</u> ne	]

## 2.6. Parallel line Library

(1). In the case of width road, its edge line shall be acquired parallel. It is helpful if the data is acquired parallel not one by one. The followings show how to set parallel as an example using "2001". "2001" shall be created on an equality with normal line data.

PA PRO	0600 Lib	orary Manag	er				- 0	×
File	Edit	<u>R</u> esources	Cata <u>l</u> og					
Libra	ry:\[	Digital_Editing	\manuals\B	urundi_sa	mple.rsc			
<u>S</u> ort b	oy: Cod	le number 🔻	) <u>U</u> nits:	Metric	▼ Sc <u>al</u> e:	5000		
Туре	Code	Level Co	olor Style	Weight	Description	Prope	erties Size	
Line	2001	Default By	/Lvl ByLvl	ByLvl	NewEntry			
Line	2002	Default By	/Lvl ByLvl	ByLvl	NewEntry			=
Line	2003	Default By	/LVI ByLVI	ByLvi	NewEntry	_		
Line	2004	2004 By 2005 By	/LVI BYLVI	ByLVI	Route non-revetu	le		
Line	2005	2005 By 2006 By	dvl Bylvi	ByLvi	Route en constru	otion		
Line	2007	2000 By 2007 By	/Lvl ByLvl	ByLyl	Sentier	Clon		
Cell	3005	Default By	/Lvl ByLvl	ByLvl	Petit batiment	3005	1.0	
Shape	3006	3006 By	Lvl ByLvl	ByLvl	Batiment en chan	tier		-
•								P.
_								
	<u>E</u> dit		Find	Crea	ate <u>D</u> e	elete	Done	
	18	1 noncon i	5 D C 4	0.50		1 - 1	000	
		A PRODUCT	Line Defini	tion	162		X	
		Common att	tributes				-	
		Code	e: 2001		Autosnap:	Asis	×.	
		Description	n: Route g	joudronn	eė			
		Command	d: Collect	Strings				
		Leve	2001		the second se			
			and the second		*	Match		
		Colo	ar: ByLe	evel		Match		
		<u>C</u> olo <u>Style</u>	e:	evel — (0) By	<ul> <li>★</li> <li>Let ▼</li> <li>Scale</li> </ul>	Match		
		<u>C</u> olo <u>S</u> tyle <u>W</u> eigh	e: ByLe	evel — (0) By — (0) By		Match		
		<u>C</u> olo <u>Style</u> <u>W</u> eigh Line attribut	e: ByLe	evel — (0) By — (0) By	▼ ▼ Lei▼ Scale	Match		
		<u>C</u> olo <u>Style</u> <u>W</u> eigh Line attribut C <u>ell</u> code	e: ByLe e: ByLe nt: ByLe tes e: 0	evel — (0) By — (0) By	▼ ↓ ↓Let ▼ Scale ↓Let ▼	Match		
		<u>C</u> olo <u>Style</u> <u>W</u> eigh Line attribut C <u>ell</u> code Patten	r: ByL e: tes e: 0 n: Unscale	evel — (0) By — (0) By —	v v v v v v v v v v v v v v v v v v v	Match 1.00 prtour code (3D)		
		Colo Style Weigh Line attribut Cell code Patter	e: ByLe e: ByLe ht: ByLe tes e: O n: Unscale	evel - (0) By - (0) By ed	ter ▼     Code     Transformed Code     Trans	Match 1.00 Intour code (3D)		
		<u>Colo</u> <u>Style</u> <u>Weigh</u> Line attribut Cell code Patter	n: ByLe e: tes e: 0 n: Unscale	evel (0) By (0) By ed	ter ▼     Scale     ter ▼     Co     in: Space     Saye	Match 1.00 antour code (3D) •		

(2). After creation of "2001", click "Create" to create a library for parallel line.

Library	r:\E r: [Cod	)igital_Edi e number	ting \mar	nuals\Bu <u>U</u> nits:	urundi_sa	mple.rsc Sc <u>a</u> le: 5000			
Туре	Code	Level	Color	Style	Weight	Description	Properties	Size	
Line	2001	2001	ByLvl	ByLvl	ByLvl	Route goudronnee			
Line	2002	2002	ByLvl	ByLvl	ByLvl	Route pavee			1
Line	2004	2004	ByLvl	ByLvl	ByLvi	Route non-revetue			
Line	2005	2005	ByLvl	ByLvl	ByLvl	Piste			
Line	2006	2006	ByLvl	ByLvl	ByLvl	Rpute en construction	1		
Line	2007	2007	ByLvl	ByLvl	ByLvl	Sentier			
Cell	3005	Default	ByLvl	ByLvl	ByLvl	Petit batiment	3005	1.0	
Shape	3006	3006	ByLvl	ByLvl	ByLvl	Batiment en chantier			
Shape	3007	3007	ByLvl	ByLvl	ByLvl	Batiment en ruine			-
*					III.			-	F

(3). Type the code number which is unused for others on row of "MultiLine codes from:" as shown below. In this case, Use "2201" as code. And click "OK".

1	PRO600 Create Library Entries
	Text codes from: to:
	Cell codes from: to:
	Line codes from: to:
	Shape codes from: to:
	MultiLine codes from: 2201 to:
	<u>O</u> K Cancel

(4). Select code "2201" and click "Edit", or double click on "2201" in order to open "PRO600 Multiline Definition".

📕 PRO	600 Lib	orary Man	ager							×
<u>F</u> ile	Edi <u>t</u>	<u>R</u> esource	s Cat	a <u>l</u> og						
Library	/:\E	)igital_Edit	ing\man	iuals\Bu	ırundi_saı	mple.rsc				
<u>S</u> ort by	r: Cod	e number	•	<u>U</u> nits:	Metric	▼ Sc <u>al</u> e:	5000			
Type	Code	Level	Color	Style	Weight	Description		Properties	Size	
Multi	2201	Default	ByLvl	ByLvl	ByLvl	NewEntry				
Cell	3005	Default	ByLvl	ByLvl	ByLvl	Petit batiment		3005	1.0	
Shape	3006	3006	ByLvl	ByLvl	ByLvl	Batiment en char	ntier			
Shape	3007	3007	ByLvl	ByLvl	ByLvl	Batiment en ruine	е			=
Shape	3008	3008	ByLvl	ByLvl	ByLvl	Cour				
Cell	4111	4111	ByLvl	ByLvl	ByLvl	Antenne		4111	1.0	
Cell	4112	Default	ByLvl	ByLvl	ByLvl	Phare		4112	1.0	
Cell	4113	Default	ByLvl	ByLvl	ByLvl	Feu		4113	1.0	
Cell	4114	Default	ByLvl	ByLvl	ByLvl	Grue		4114	1.0	*
•					111					•
	<u>E</u> dit		Find		Crea	ate D	<u>elete</u>		D <u>o</u> ne	

(5). In the "PRO600 Multiline Definition" window, type the description such as feature's name at "Description:". Type command "Collect Strings" at "Command:". Select "2001" at "Level".

Common attrib	utes			1
Code:	2201	A	tosnap:	As is
Description:	Route goudre	onnee		
Command:	Collect Curve	s		
Level:	2001	٠.	1	Match
Color:	ByLevel		L	
Style:	(O	) ByLer 🔻	Scale	1.00
Weight:	(O	) ByLer +		
Iultiline attribi <u>Gr</u> aphi	ites <u>B</u> aseline: [] c grouping: []	^o rimary clas: All lines	s .	
Iultiline attrib	utes Baseline: (F c grouping: (F	Primary class All lines	•	•
Iultiline attrib Graphi Id Line	utes Baseline: [] c grouping: [] XY Offset	Primary class All lines Z Offset	s v Ref	Reverse
<u>G</u> raphi d Line Add	Jaseline: [] Baseline: [] c grouping: [] XY Offset	Primary class All lines Z Offset	s • Ref	Reverse Preview

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(6). Click "Add..." under "Multiline attributes" then the "Multiline Offset Definition" window appears. Type and select any parameters as shown below. And click "Save".

Multiline Offs	et Definition
Offset Id: Line code: XY Offset: Z Offset: Belative to:	1         Sample           2001         Digitised         at: 0.000           Fixed         at: 0.000
	Reverse direction for patterning
Next	Prev Save Cancel

(7). After click "Save", the contents of the "PRO600 Multiline Definition" window are shown below. And click "Save".

PRO600 M	ultiline Defin	ition	[et	- E 🔀
Common attri	outes			
Code:	2201	Au	tosnap	As is 💌
Description:	Route goud	ronnee		
Command:	Collect Curv	es		
Level:	2001	•	1	Match
Color:	ByLevel	•	1	
Style:		0) ByLer 🔻	Scal	a 1.00
Weight:		0) ByLer 🔻		
Multiline attrib	utes <u>B</u> aseline: ( ic grouping: (	Primary class All lines		•)
ld Line	XY Offset	Z Offset	Ref	Reverse
1 2001	Digitised	0.000	0	No
Add	Edit.	Dele	ate .	Preview

(8). By doing above mentioned the way of creating libraries, it is possible to create necessary libraries of point, line and polygon data. Finally, click "Done" in the "PRO600 Library Manager".

📕 PRO	600 Lib	rary Mar	ager							x
<u>F</u> ile	Edi <u>t</u>	<u>R</u> esource	s Cat	a <u>l</u> og						
Library	/:\D	)igital_Edit	ing\man	iuals\Bu	urundi_sa	mple.rsc				
Sort by	r: Cod	e number	•	<u>U</u> nits:	Metric	▼ Sc <u>al</u> e:	5000	)		
Туре	Code	Level	Color	Style	Weight	Description		Properties	Size	
Multi	2201	2001	ByLvl	ByLvl	ByLvl	Route goudronn	ee	{2001}		
Cell	3005	Default	ByLvl	ByLvl	ByLvl	Petit batiment		3005	1.0	
Shape	3006	3006	ByLvl	ByLvl	ByLvl	Batiment en cha	ntier			
Shape	3007	3007	ByLvl	ByLvl	ByLvl	Batiment en ruin	e			=
Shape	3008	3008	ByLvl	ByLvl	ByLvl	Cour				
Cell	4111	4111	ByLvl	ByLvl	ByLvl	Antenne		4111	1.0	
Cell	4112	Default	ByLvl	ByLvl	ByLvl	Phare		4112	1.0	
Cell	4113	Default	ByLvl	ByLvl	ByLvl	Feu		4113	1.0	
Cell	4114	Default	ByLvl	ByLvl	ByLvl	Grue		4114	1.0	-
•					III					Þ.
[	<u>E</u> dit		Find		<u>C</u> rea	ate [	<u>)</u> elete		D <u>o</u> ne	

### 2.7. Library Manager

- (1). These are how to open the Library Manager.
- ♦ Select PRO600 > Library > Open... in the MicroStation menus. Select the appropriate PRO600 Library (*.rsc) file in "PRO600 Library" window.

🕌 Burundi_gitega_5k.dgn [3D - V8 DGN] - MicroStation V8i	(SELECTseries 2)		
🥪 🔹 🔽 🛪 🔁 0	• 🗟 1 • 🐧	0 • 🖄 0 •	1
File Edit Element Settings Tools Utilities Wor	kspace <u>W</u> indow	P <u>R</u> O600 <u>H</u> elp Settings	1
Tasks	X: 492817.0941	Editing	
Drawing Composition	Y: 9620815.937	Library •	<u>N</u> ew
	E. 0.0000	<u>T</u> ools	Open
	PRO60	View •	Manager

Directories:	
\Digital_Editing\manuals\	
D:\ Digtal_Editing manuals	OK
	Cancel
Drives:	
	Directories: \Digital_Editing\manuals\ D:\ Project_Trainning Digital_Editing manuals Drives:

♦ Select PRO600 > Library > Manager... in the MicroStation menus. The appropriate PRO600 Library (*.rsc) file is opened.

🏽 🖈 🕅 7304 🔹 🛃 27 🔹	0 + 🗟 1 + 🕻	1 . · E .	+	
<u>File Edit Element Settings Tools Utilities V</u>	Nor <u>k</u> space <u>W</u> indow	P <u>R</u> O600 <u>H</u> elp		
$[\mathbf{n} \cdot \mathbf{n} \cdot$	- A + A + A	Settings		
	17 Set 112		_	
Tasks	Nee	Editing		
Tasks	X: 492809 4935	Editing Presentation	*	
Tasks	X. 492809.4935 Y: 9620710.768 Z: 0.0000	Editing Presentation	•	<u>N</u> ew
Tasks	X. 492809.4935 Y. 9620710.768 Z. 0.0000	Editing Presentation Library Tools	* * * *	New Open

(2). To draw the contour data, the following setting needs. Select **PRO600** > **Settings...** in the MicroStation menus.

H Burundi_gitega_5k.dgn [3D - V8	DGN] - MicroStation V8i (SELECT	(series 2)		
- 7304 -	27 • 🗟 0 • 🕎	1 + 1	• 0 🖌	4 a + 1
<u>File E</u> dit E <u>l</u> ement <u>S</u> ettings	<u>T</u> ools <u>U</u> tilities Wor <u>k</u> space	Window	P <u>R</u> O600	Help
🚺 • 🗈 • 📻 • 🚳 • 🕻		J - (i)	Setting	Sm

(3). In the "PRO600 Preferences" window, check on "Online contour rounding" and type "20" on "Tolerance (% of interval):". This means that the elevation of contour data which is within 20% range of contour interval shall be round onto value of its interval during plotting. For example, 1.20m rounds to 1.00m. similarly, 0.8m rounds to 1.00m.

PRO600 Preference	es (PF	ROCART]
<u>Category</u> Contour rounding Data cleaning Data collection Display modes Driver operation Driver preferences Driver startup Feature coding Feature highlight Image transform Library catalog Object creation Overlay content Overlay operation Patterning Snap locks Snap to ground Spatial reference	E E	Settings used by contour rounding         Image: Online contour rounding         Image: Inderance (% of interval);         Image: Online contour interval;         Project contour interval;         2.500         Cancel         Help

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## 3. Setting of TopoMouse

(1). TopoMouse which is shown below must be set for data acquisition.



(2). The "Leica Photogrammetry Suite – PRO600" window displays aerial photos as shown below.



(3). To set the TopoMouse, select **Edit** > **Devices...** in the menus as shown below. The TopoMouse is not recognized automatically in LPS when it just connects to computer.

🖌 File 🛛 E	dit View Windo	w Help			
th Mt	Devices	🔄 🖉 2ª 2ª 🔍 Zoom L	evel: 4:1	- 🔳 - 🕄	
Project	Settings		×	1	A COLUMN
/ plot_se	tting.blk				11
🗄 🖾 Ima	ige Pairs				
- 0	burundi_10_0561.t	f - burundi_10_0560.tif	1.12		
	burundi_10_0562.t	f-burundi_10_0561.tif	1.000		
-9	burundi_10_0563.t	f - burundi_10_0562.tif	100		
	burundi_10_0564.t	f - burundi_10_0563.tif	ALC: NO		
	burundi_10_0565.t	f - burundi_10_0564.tif	1000		1.00
-0	burundi_10_0566.t	f - burundi_10_0565.tif			11 C 42
100	1 TO 05071	I how all in DECENT			

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(4). In the "Devices" window, click "Add..."

Device Selection:	
System Mouse	Properties
	Button Mappings

(5). The "Add Device" window appears. Select "TopoMouseUSB" and click "OK".

Add Device	<b>•</b>
Devices: Immersion mouse-trak SpaceExplorer Stealth 3D (Immersion) Stealth Z-Mouse System Mouse TopoMouse TopoMouseUSB	Device Port Settings COM Port:
OK Ca	ncel Help

(6). "TopoMouseUSB" is listed in the "Devices" window. Click "Properties..." after select "TopoMouseUSB".

evices	<b>•</b>
Device Selection:	
System Mouse	Customize
TopoMouseUSB	Properties
	Button Mappings
	(and the second second
Add Remove	Close Help
The second secon	

(7). The "TopoMouseUSB Properties" window appears. The parameters are set as shown below.

TopoMouseUSB Pro	operties					X
TopoMouseUSB Pr	operties					
Axis-To-Ground X Y	Setting: × 0.10	s Y 0.004 0.104	Z 0.001 0.001			
wneel	0.00	0.00	0.10			
Speed Changer Multiplier Slew Settings	r Setting X	s #1 5.00	#2 0.20i Z			
Counts	1	1	1			
Clutch Button Settings Only while button is held down Toggles CLUTCH on/off						
Emulate Syste XY Squared N Disable Z Mot	em Mous fotion iion	e				
ОК	Cance		Apply	,	He	lp

(8). It is possible to change the cursor style of TopoMouse.

	Settings	X	2 [®] 2 [®] Q	Zoom L 4	evel: 4:1	- N	•	<b>.</b> •
_setting	j.blk Pairs				4	-4		
buru 🗿	undi_10_0561.tif	- burun	di_10_0560	).tif				
	Settings							X
	Project Explorer	Cursor	Unit display	Loading	Viewing	Terrain correla	ation	
	Shape			Attrib	outes			
	<ul> <li>Dot</li> </ul>			Line	weight:	4	A. Y	
	O X			Cur	sor size:	16	*	
	O Crass			Cole				
		Contact of		COR	л.		118	

TopoMouse consist of 16 buttons and a Z wheel as shown below. All buttons have each function. In this manual, explanation of each function skips.



**Note**: For further information of TopoMouse, see the manuals by Leica in the following address. Installation drive\Program Files\Leica Geosystems\PRO600\Acrobat\English\Prolps.pdf

(9). During acquisition of the data, height information of all features has to be acquired with Z whole of TopoMouse accurately. The followings show samples in cases of accurate and not.

Manual for Digital Plotting II

#### 4. Displaying stereo models

 In LPS, there are 5 options for displaying stereo model as shown below. (In this manual, it is impossible to show condition of stereo image. Stereo images is shown like a single image)

The "Tri-View" is recommended for beginners because it is possible to confirm a cursor among stereo image, left image and right image at a once.

Burundi_gi	tega_5k.dgn - PRO600			
Project Ex	Cursor Mode Cursor Behaviour	3 9	Zoom Level: 4:1	• 🗄 •
Image Ad	Layout	•	Stereo	* w 1: burundi_10_0
Move Cur.	Panels	•	✓ Tri-View Split	12 12
View Manag	er		Left Image Only Right Image Only	12





(2). The followings show how to set specified Z value (height).

When typing  $Z^{**}$  (** indicates digit) in the command line and press "Enter", Z value set ** m.

The following example shows how to set Z value to 10m.





## 5. Data acquisition

(1). The appropriate library must be selected in the Library Catalog before the data acquisition as shown below.



In the case of 2003	In the case of 3001	In the case of 7101
Vibrary Catalog (Burundi-5       Image: Catalog (Burundi-5         1001       Border         1002       Boundary of Commune         1004       Boundary of Commune         1005       Boundary of Commune         1006       Boundary of Sub-coline         1007       Soundary of Sub-coline         1008       Boundary of Sub-coline         1009       Boundary of Sub-coline         2002       Paved road more than 2.5m in width         2002       Unpaved road more than 2.5m in width         2005       Road under construction more than 5m in         2007       Foca under construction more than 5m in         2007       Foca path         2008       Median strip and rotary(more than 2.5m in width         2010       Brodge for vehicles         2011       Light bridge(footbridge)         2012       Culvet         2018       Unpaved road (Center line) for GIS         20101       Brohalt paved road (Center line) for GIS         20102       One eroty building more than 10m in long side         20103       Brohalt paved road (Center line) for GIS         20104       Hangar(more than 10m in long side)         2005       Building less than 10m in long side)         20105	✓       Library Catalog (Burundi-S       □       ■         2101       Asphalt-paved road?Center line) for GIS       10       2102       Paved road (Center line) for GIS         2102       Paved road (Center line) for GIS       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10	↓       Library Catalog (Burundi-5       □       ⊠         6006       Familand (mixed plantation)       6007       Swamp familand         6008       Paddy field       6009       6009         6009       Green belt       6010       Boundary of national park         6011       Row of trees more than 50m in length       6101       Eucalyptus         6102       Palm tree       6103       Banana         6104       Coffee       6105       Tea         6105       Tea       6106       Sugar cane         6107       Cotton       6108       Paprus         7101       Index contour (25m)       7102       Principal contour (25m)         7102       Principal contour (25m)       7104       Depression contour (Principal) (5m)         7105       Depression contour (Principal) (5m)       7201       Embankment more than 50m in length and 12         7203       Thalwage more than 50m in length       7204       Soil : rocks       7205       Soil : soid         7204       Soil : cocks       7205       Soil : soid       7301       Original Control point         7303       Bench mark       7304       Spot elevation       7305       Spot hight       ▼         1205

(2). The following pictures show sample of the order of data acquisition.





**Note**: For further information of LPS, see the manuals by Leica in the following address. Installation drive\Program Files\Leica Geosystems **Digital Compilation** 

Manual for Digital Compilation 1

# **The Basic Operation manual of MicroStation**

## < Objective>

For understanding about "Digital plotting", "Digital compilation" and "Symbolization", it is necessary to understand the manipulation of the "MicroStation" basically. This document mentions elementary manipulations.

## <Required Basic Manipulations for the training>

1. View Control Menu
2. Drawing Menu
3. Main Menu
4. Other Useful Menu
5. File Setting



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## 1. View Control Menu



ID		Command	Contents	Action
V1:	1	View	Set View Attribute	Click Icon then active required
View Setting		Attribute		attribute in the setting window
	2	Display	Define Display Style	Click Icon then choose proper
		Styles		style in the setting window
	3	Adjust View	Change View Brightness	Click Icon then move bar on
		Brightness		proper brightness
V2:	1	Update	After modification, Update	Click Icon then "Lmb" in the
View Control		View	the result of modification.	view
	2	Zoom In	Increase the magnification	Click Icon then "Lmb" in the
			of a view.	view
	3	Zoom Out	Decrease the magnification	Click Icon then "Lmb" in the
			of a view.	view
	4	Window	Define the showing area in	Click Icon then "Lmb" at the
		Area	the view.	Upper left and "Lmb" at the
				Lower right of the area
	5	Fit View	Show all data and fit into	Click Icon
			the View.	
	6	View	Define View Rotation	Click Icon 1-2 second then
		Rotation	(Direction)	Choose proper rotation
	$\langle 7 \rangle$	Pan View	Move the center of view	Click Icon then "Lmb" in the
				view and move cursor ("Lmb"
				for Decide, "Rmb" for Cancel)
V3:	(1)	Walk	Rotate view interactively	Click Icon then set in the
Walk and UNDO			** 1	window
	(2)	Go to	Undo	Click Icon
		Previous		
		View		
	3	Go to Next	Redo	Click Icon
X74.	0	View	Commenting advector	
V4:	U	Copy View	Copy active view	then "I mh" in the new view
Auvancea view	0	View	Change View Derensetive	Click Loop then "I mh" in size
		Dorepostivo	Change view Perspective	and move cursor
	3	Advanced	"Soo Holp"	
	9-	functions	See Help	
		Tunctions		

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## 2. Drawing Menu



ID		Command	Contents	Action
Q:	1	Place Smart	Draw a continuous	Click Icon then "Lmb" on each
Draw line and		line	line	point until last point and "Rmb"
point				after last point
	2	Place Line	Draw a line by 2	Click Icon then "Lmb" on each
			points (Start and	point until last point and "Rmb"
			End) lines	after last point
	3	Place	Create parallel	Click Icon then set Styles in the
		Multi-Line	line	window and Draw line
	4	Place Active	Create points	Click Icon then a choose function
		Point		then Place points
	5	B-Spline by	Create Stream	Click Icon then "Lmb" on each
		Points	Line by Arc	point until last point and "Rmb"
			Segment	after last point
	6	Place Stream	Create Stream	Click Icon then Push "Lmb" then
		Line String	Line by	move cursor
			"hold-down"mode	
	$\bigcirc$	Place Point	Create Stream	Click Icon then "Lmb" on each
		or Stream	Line by points	point until last point and "Rmb"
		Curve		after last point
	8-	Advanced	"See Help"	
		functions		
W:	1	Place Block	Create Rectangle	Click Icon then "Lmb" at the Upper
Draw Polygon				left of the area and Click "Lmb" at
				the Lower right
	2	Place Shape	Create	Click Icon then "Lmb" on each
	-		shape(Polygon)	point until last point and Click
			r ( 70- 9	"Close Element"

				Manual for Digital Compilation
	3	Place Orthogonal Shape	Create shape(Polygon) with "right angle" mode	Click Icon then "Lmb" on each point until last point and Click "Lmb"
	4	Place Regular Polygons	Create shape(Polygon) with defined edges	Click Icon then set Edges and "Lmb" on the center of Polygon then decide size
E: Draw Arc	1	Place Circle	Create Circle	Click Icon then "Lmb" on the center of Circle and decide size
	2	Place Ellipse	Create Ellipse	Click Icon then "Lmb" on the center and decide direction then decide size
	3-	Advanced functions	"See Help"	
R: Hotob	1	Hatch Area	"See Help"	
Hatti	(2) (3)			
	(4)- (7) (8)	Advanced functions	"See Help"	
T: Tag			"See Help"	
A: Text(Annotation)	1	Place Text	Put Text(Annotation, Comment, etc)	Click Icon then Type text into the "Text Editor" and set styles then Click "Lmb" on the point in the Window
	2-	Advanced functions	"See Help"	
S: Cell(Symbol)	1-	Place active Cell	"Symbolization"	
D: Distance	1	Measure Distance	Measure the distance between 2 points.	Click Icon then "Lmb" on each point from 1 st point and 2 nd point, then see "Measure Distance" window.
	2-	Advanced functions	"See Help"	
F: Dimension	1)-	Advanced functions	"See Help"	

Notice: "See Help" means Go to "Help"-> "Tool Index" and Type keywords in dialog box" into "Index" Tag.

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#### 3. Main Menu



ID	_	Command	Contents	Action
M1:		Element	Select elements(one	Click Icon then "Lmb" on a target
Selection		Selection	by one).	element
M2:	1	Place Fence	Define area for	Click Icon then "Lmb" at the Upper
Fence			Selection and	left of the area and Click "Left" at
			Process.	the Lower right
	2	Modify	Modify placed	After place a fence, Click Icon then
		Fence	Fence	"Lmb" on the view and decide the
				size
	3	Manipulate	Copy, Move, Rotate	After place a fence, Click Icon
		Fence	elements inside	and choose manipulation then
		Contents	Fence	"Lmb" on the view and move cursor
	4	Delete Fence	Delete elements	After place a fence, Click Icon
		Contents	inside Fence	then "Lmb" on the view
	5-	Advanced	"See Help"	
		functions		
M3:	1	Сору	Copy selected	Click Icon then "Lmb" on target
Manipulate			element	element and after move cursor,
				"Lmb"
	2	Move	Move selected	Click Icon then "Lmb" on target
			element	element and after move cursor,
				"Lmb"
	3	Scale	Change size of	Click Icon and set scale then
			selected element	"Lmb" on target element and
				after move cursor, "Lmb"
	4	Rotate	Rotate selected	Click Icon and "Lmb" on target
			element	element then decide direction

				Manual for Digital Compilation 1
	5-	Advanced	"See Help"	
		functions	-	
M4:	4	View Control	"See Chapter 1"	
View Control				
M5:	1	Change	"See Chapter 3.1"	"See Chapter 3.1"
Change		Attribute	-	-
Attribute				
	2-	Advanced	"See Help"	
		functions		
M6:		Advanced	"See Help"	
Groups		functions		
M7:		Modify	"See Chapter 3.2"	"See Chapter 3.2"
Modify			-	
M8:		Delete	Delete Element(one	"Lmb" on target Element then
Delete Element		Element	by one).	"Lmb"

Notice: "See Help" means Go to "Help"-> "Tool Index" and Type keyword into "Index" Tag.

3.1 Change Attribute (Level, Color, Style, etc)



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### 3.2 Modify (Extend, Trim, Delete etc)



	Command	Contents	Action
1	Modify	Change the size of Element.	Click "Lmb" on a element and move.
	Element	Move a segment of Element.	
2	Partial Delete	Delete a section of a elemet.	Click "Lmb" at the start point and Click
			"Lmb" at the last point.
3	Break Element	Segment an element into	Click "Lmb" at the point should be devided.
		several parts.	
4	Extend line	Extend a line to optional	Click "Lmb" on an element and Click "Lmb"
		point.	at the point to be extended.
5	Extend element	Extend two lines to the cross	Click "Lmb" on an element and Click "Lmb"
	to intersection	point.	on another.
6	Extend element	Extend a line until target	Click "Lmb" on a element to be extend and
	to other element	element.	Click "Lmb" on the other.
Ø	Trim elements	Delete element overshooted	Click "Lmb" on the border element and then
		(One by One)	Click "Lmb" on overshooted part.
8	Intelli Trim	Delete element overshooted	Click "Lmb" on the border element and then
		(using line)	Draw line on overshooted part.
9	Insert Vertex	Add new vertex into an	Click "Lmb" at the point to be inserted
		element	
10	Delete Vertex	Delete vertex	Click "Lmb" at the vertex to be deleted
	1 2 3 4 5 6 7 8 8 9 0	Command①Modify Element②Partial Delete③Break Element③Extend line⑤Extend element to intersection⑥Extend element to other element⑦Intelli Trim⑧Intelli Trim⑨Delete Vertex	CommandContentsImage: Image:

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## 4. Other useful Menu (From Primary Tools)



ID	)	Command Name	Contents	Action
Р	1	References	Attach/Dettach other vector	"See Chapter4.1"
			files(Dgn, Dxf, etc)	
	2	Raster Manager	Attach/Dettach raster vector	"See Chapter4.2"
			files(Tiff, Jpeg, etc)	
	3	Level Manager	Control styles of elements in "See Chapter 4.3"	
			each level.	
	4	Level display	Change ON/OFF on display	"See Chapter4.4"
			by level.	
	5	Element	See Information of selected.	Click Icon then "Lmb" on target element.
		information		

#### 4.1 References

E



Attach		1 1 20 4	i 🖞 🛈 🗙	Hite Mode: Boundarie	95 <b>•</b>		
Detach Detach All	Model	Description	Logical	Orientation	Presentation	JAG	
Reload	iK30. Default	Aligned with Maste	er.a	Coincident	Wireframe 🗸	4.4	
Reload All	1.000			Attach Reference			
Exchange				File Directory	1		
Open in New Session				Files:		Directories:	
Deactivate				Index_5K_GK30_9	9999_Gitega.dgn	D:\!Project_Trainning\Digital_Ed	iting\ 3D - V8 DGN
Move				Burundi_blank.dgn	1	₽ D:\	
Сору				Burundi_gitega_5k	_0308.dgn - 0822.dap	Project_Trainning	
Scale	1.000000	Edutation 0	H I	Burundi_gitega_5k	_tr1.dgn	manuals	
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				List Eles of Turos:		Driven	Attachment Method
				CAD Files (*.dgn;*.	dwa;*.dxf]	D:	Interactive

THE STUDY ON ESTABLISHING DIGITAL TOPOGRAPHIC DATA BASE FOR BUJUMBURA CITY IN REPUBLIC OF BURUNDI

#### 4.2 Raster Manager

- 🖉 - 🛃 -	· · · · · · · · · ·	a • 🕧 🕁 🕱 🛛
🧾 Raster Manager : !	5 of 5 listed	
File Edit View	Display Settings Utilitie	s
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Batch Convert		1
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¥ [	10	<u>*</u>
12345678	Int:	Transparency:

#### 4.3 Level Manager

	v: BvLevel ▼	(none) -	a -		
- Burundi_gitega_5k_0	∆ Name		-	-	Used
Index_5K_GK30_	Default	0			0
All Levels	1001	4	7	2	2
-D Filters	1002	20	4		2
	1003	5	6		1
	1004	21	5		"I mh" on target(Color Styl
	1005	29	1		Lino on target(Color, Styr
	2001	4			2 Weight) then change setting
	2002	20			2
	2003	3			1
	2004	3	0		2
	2005	3	3		2
	2006	10	3		1
	2007	3	2		2
	2008	10			D
	2009	10	0		2

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#### 4.4 Level Display



4.5 Element Information



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## 5. File setting

Elle         Edit         Element         Settings         Tools         Utilities         Wo           Tasks         ✓         Tool         Settings	
Tasks       AccuDraw         Drawing C       Color Books         Color Table       Database         Organize       Design File         Drawing       Display Styles         Drawing       Evels         Evels       Fence         Gird       Isometric         Locks       Snaps         Stream       Views         Working Units       Working Units	Modify Working Unit Settings Linear Units Eomat: MU Master Unit: Meters Sub Unit: Millimeters Accuracy 0.1234 Custom Advanced Settings Resolution: 10000 per Distance Meter Working Area: 9.0072E+008 Kilometers Solids Area: 1 Kilometers Solids Accuracy: 1E-008 Meters Edit Focus Item Description Select category to view.

Manual for Digital Compilation II

# **Instruction for compilation of plotted data**

### <Objective>

The objective of compilation in this project is creating polygon data for Cartography.

For creating polygons, "Data clean up" (Delete short elements, Delete Duplications, Fix Gaps and Dangles) and "Create Topology" are required.

## <Work flow of Digital Compilation >

The flow in this work is following.


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## 1. Sorting Layer

## 1.1 Type of data

There are 4 types of elements in the topographic data as follow.

T	ype of data	Explanation	Examples	s in this project	Remarks
1	Line	Line composed	Administrative Boundary	Boundary of Commune (2001)	Used for the
1	Smartline	vertex	Road	Unpaved road (2004)	Polygon
		vertex	River	Stream (5103)	Torygon
			Small Buildings	Primary school (3110)	
	Point		Small Structures	Antenne (4111)	
2		Origin	Points Géodésique	Original Control point	
	Cel			(7302)	Used to
	(Symbol)				distinguish
			Annotations		the area to
			(Name of	Administrative unit (8101)	be
3	Text	Characters	administrative area)		polygonized
			(Name of Lake etc,)	Other toponym(8101)	
			Paved road	Asphalt paved road (2001)	Created by
1	Dolygon	Enclosed area	Vegetation area	Paddy field (6008)	using of
4	rorygon	Elicioseu alea			Data type
					1-3

1.2 The theory of creation of polygon.



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1.3 The part of each type of data

To know the classification of type for the generation of "Polygon", See "Burundi_feature_catalog_5k.xls" and "Burundi_feature_catalog_25k.xls".

## 2. Data Cleaning

2.1 The manipulation to open the "**Data clean up**" Tool. Open "BENTLAY MAP"

## 2.2 OPEN Data Clean up tool

Utilities > Data Clean Up



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# 2.3 Clean up Tools



II	)	Command Name	Contents	Action
CL	1	Find duplicate	Find duplicate element and	Place Fence then Click Icon and set in
		linear elements	Delete or Move into Selected	the window then "Lmb".
			Level	
	2	Find similar linear	Find similar element and Delete	Place Fence then Click Icon and set in
		elements	or Move into Selected Level	the window then "Lmb".
	3	Find linear element	Find small element(less than	Place Fence then Click Icon and set in
		fragments	tolerance) and Delete or Move	the window then "Lmb".
			into Selected Level	
	4	Thin linear elements	Thin(mabiki) unnecessary	Place Fence then Click Icon and set in
			smaller than tolerance	the window then "Lmb".
	5	Segment linear	Separate elements(Break) on	Place Fence then Click Icon and set in
		elements	each cross point	the window then "Lmb".
	6	Find gap	Find Gap element(less than	Place Fence then Click Icon and set in
			tolerance) and Delete or Move	the window then "Lmb".
			into Selected Level	
	Ø	Find dangles	Find Dangle element(less than	Place Fence then Click Icon and set in
			tolerance) and Delete or Move	the window then "Lmb".
			into Selected Level	
	8	Connect contiguous	Connect segmented elements	Set Fence "Block" and "Overlap" then
		line work	into 1 element	put Fence on the connection of target
				elements then "Lmb".
	9	Find area slivers	Find small areas not required in	Place Fence then Click Icon and set in
			the map then Merge or mark	the window then "Lmb".
			Flag	

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## 2.4 The Workflow of "Data Clean up" and required "Tool"

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Cl	assification of elements for	Exemples				
	Clean up	Before	After			
А	Duplication	Zu Zu	Zu			
В	similar linear elements	Zu	Zu .			
С	Find linear element fragments					
D	Linear elements shall be thinned					
Е	Segmentation	ZuZu	Zu			
F	Gap	Zu 71	∠u 7ı			
G	Dangle	Zu	Zu			

# 2.5 The type of Errors shall be fixed in "Data Clean up" work.



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2.6 The Manipulation (Setting) of each "Data Clean up" tool.

In case the errors shall be not delete but move into a "Level", the "Level" (ex: name = "ERROR") must be created before "Data Clean up"

A) Delete duplicating elements.

Topology Cleanup	8
Q R Q B B B + + F	P
🚯 Find Duplicate Linework 📼 💷 🗪	
Mode Move	
	In case of "Move",
Rows 1	Choose Level to be
Level	

B) Delete similarly duplicating elements

Copology Cleanup Image: Second sec	3
Mode Move   Delete   Eac   Merge   Columns   Hag   Rows   I   Iolerance   15.00	In case of "Move", Choose Level to be moved

Manual for Digital Compilation II

C) Find linear element fragments

Topology Cleanup	83
	in a' 📭
1 Find Linework Fragments	In case of "Move",
Mode Move	Choose Level to be moved
Tolerance 1.000000	
level	

D) Linear elements shall be thinned

Topology Cleanup	83
Q Q Q B + + F	цр.
(h Thin Linear Element 📼 🖻 🗙	 N
	Choose "one by
Mode  Single Element	encose one of

E) Segmentation

Topology Cleanup	.†. †.   ≠ [	Image: State of the state of t	
Segment Linear El Mode Iolerance	ement Split Single Elements Self 0.000000 etize 1	Cho one fend	bose "one by " or "all" inside ce

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F) Find gap

1	opology Cleanup	2	3
L		Fin d D	
Find Gaps		🖞 Find Gaps	X
Mode > Rag Unconnected End	ooints	Mode Flag Unc	onnected Endpoints
Hag All Repair U <u>n</u> connected E Repair All	ndpoints	<u>T</u> olera	nce 1.000000
<u>F</u> acetize <u>C</u> olumns 1 <u>R</u> ows 1		<u>C</u> olu B	Eacetize
✓   Write Flags     Level			Write Flags vel
G) Find Dangle	Choose "Mark only( delete) " or "I	not Delete"	
7	opology Cleanup		3
	Find Dangles		Choose "Mark only(not delete) " or "Delete"

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2.7 The result after "Data Clean up".



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## 3. Create Topology

#### 3.1 Create Topology

Open tool boxes "Topology Cleanup" and "Topology Creation".



#### 3.2 Polygon Creation 1 Tools



II	)	Command Name	Contents	Action
TC	1	Create shapes	Create shapes by "text" or	Place Fence then Click Icon and
			"Cell" into active Layer	"Lmb".
	2	Create centroids	Create Centroid inside closed	Place Fence then Click Icon and set in
			area as the preparation for	the window then "Lmb".
			"Create shapes"	
	3	Associate Linkages	Advanced Function	
	4	Validate Topology	Detect the position of	Place Fence then Click Icon and then
			Topology	"Lmb".
	5	Merge Polygon	Merge some polygons into a	Click Icon then Choose polygons shall
			polygon	be merged.
	6	Split Polygon	Split a polygon by line	Click Icon and Choose a polygon then
				Draw a line to Split.

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3.3 Work flow of "Topology Creation"



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- 3.4 The Manipulation (Setting) of each "Topology Creation" tool
  - 1). Select a level where polygon shall be created.

File	Edit	Element	Settings	Tools	Utilities	Workspace	<u>Window</u> <u>H</u> elp
------	------	---------	----------	-------	-----------	-----------	----------------------------

2). Show symbols (texts, cells) inside areas required to be created polygons into active layer.



- 3). Place a Fence.
- 4). Click "Create shape" Icon.

Topolo	gy (	Creati	on	*
E		2		

5). "Lmb" on the view.



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6). Check Result.



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## 3.5 Merge and Split Polygons

1). Merge Polygons



Identify element one by one >>> Lmb(out from element)







2). Split Polygon

Торо	logy	Creati	on		 I
Ħ	••	5		E	
					2

Identify element >>> accept (Lmb) >>> Place "Cut line" >>> Rmb





Period